# The ELECTRICAL REVIEW

FOUNDED 1872

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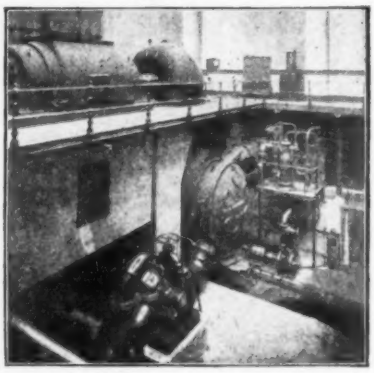

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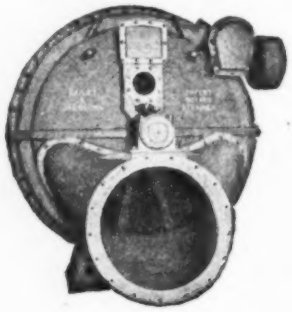

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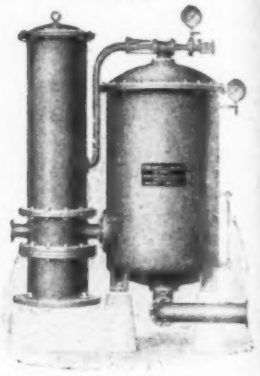

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# Electrical Review

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# Popular Electrical Enterprise.

IT is a little curious at a time when the popular interest in electrical contrivances is so great, consequent upon the introduction of wireless into more than a million households representing all grades of society, that we should be obliged to confess that there is a widespread ignorance concerning other electrical articles which have such a wonderful potentiality as burden-lifters and comfort-givers.

Wireless has changed the habits of hundreds of thousands, and it is not going to be so temporary an influence as was at one time imagined. Electrical domestic service changes the habits and the atmosphere of any household in which it has a full and fair chance, and the housewife rapidly grows into electrical ways until they become permanent, and emphatic expression is given to the determination never to revert to former methods.

What we ought all to recognise is the need for disseminating the truth of the matter in order that electrical service may have that full and fair chance to which we have referred. It is not only the user of agents other than electricity whom we have to impress, though this section of the community is in the majority; the user of electricity needs informing as well, for unsatisfied consumers are to be met who have installations as old as Adam and as ugly as sin, and who fail to appreciate the excellent qualities of the many electric fires now available because they are making use of primitive luminous radiators.

This subject of the removal of public electrical ignorance is not by any means a new one. The Electrical Development Association was formed to handle it, and efforts of a fitful kind by others preceded it, but much as we may believe that there is no better propaganda

than the testimony of the satisfied consumer, we cannot leave such testimony to over-the-garden-wall gossip or to afternoon tea chats. We have got to bring it out and make a shout about it on the well-thought-out plan and on the grand scale with manifold publicity loud-speakers.

Reference to the report of the Council of the B.E.A.M.A. shows that that organisation holds that while E.D.A. has continued to actively pursue electrical publicity work in conjunction with the municipalities and the supply companies, "it is essential that this work should be continued on a larger scale." But how can this be unless "more active support" is forthcoming "from those engaged in electric supply"? That is a criticism of the electricity undertakings for their failure to give adequate support, and we can well believe that it is abundantly justified, but if one thing is more certain than another it is this, that added assistance from the manufacturers of electrical plant, cable, and appliances will also be required if there is to be a movement of anything like the proportions that the opportunity and the prospect seem to justify. The Council of the B.E.A.M.A. holds that the electrical industry may look forward to larger developments "if that co-operation, already so valuable, between members, the supply industry, and other purchasers can be continued and increased." There is no better field surely in which co-operative effort between these and the other different sections can be employed than this one of electrical propaganda.

This thought brings to mind the use of exhibitions as a means for spreading the truth, and the question of a joint policy relating to efforts of this class. A few weeks ago we gave a forecast of the various exhibition events in which electrical firms might be interested, and we remarked that manufacturers would be able to exercise their discrimination and to take their choice. The frequency and overlapping of exhibitions is a question with which manufacturers are concerned, but not they alone. We recall that one of the first matters on which they found it possible to work conjointly in the days when the N.E.M.A., from which the B.E.A.M.A. sprung, was taking form, was the prevention of the too-frequent promotion of exhibitions out of which private promoters could make profits from the electrical industry. Since then the B.E.A.M.A. has had an exhibition policy under which it has exercised a certain influence relieving its members from the need for participation in any and every such event that came along. It cannot, of course, pursue a policy of complete prohibition of all exhibitions save those which have its *imprimatur* for the electrical industry is a far bigger affair nowadays, and the need for local exhibitions, even sometimes on an ambitious scale, is a matter of local knowledge, and there are enterprising non-manufacturing exhibitors who make very helpful displays. But there is some justification for the view of the Council that what they regard as "almost an epidemic"—so operating as to render it "almost an obligation" for manufacturers to take a hand in all sorts of exhibitions by whomsoever promoted, "overlapping as to subject, conflicting in date, and generally without system of any sort"—has brought them to a time when the recent "rather lenient practice of granting applications under the standing rule" requires re-consideration. Whatever may emerge as the result of the proposed review of the whole position, it seems to us that this exhibition question is very closely related to the whole problem of the future, and we trust enlarged, activities of the E.D.A., and it is certainly one of the points upon which the co-operative spirit of manufacturers, electricity supply authorities, electrical contractors and wholesalers might concentrate. E.D.A.'s existence is designed to bring about the maximum popularisation of electricity, and that circumstance alone should be a safeguard against excessive efforts to repress local action. E.D.A.'s influence should be central and local too, and by the very nature of its constituent parts it should be capable of helpfully shaping the course of useful exhibitions wherever the local conditions prove them to be necessary. The Association's efforts, however, cannot be conducted on that large scale directly, nor can it act alone. It has not the funds yet, and many supply authorities find that it pays them well to incur expenditure for their own local displays. Enterprise, too, on the part of local retailers, traders, and contractors, goes far to make for the success of local shows. Nevertheless, these considerations do not dispose of the desirability for some effort to be made to avoid too much overlapping as to date or too great an activity on the part of those who run exhibitions merely for private profit and not for the purpose of accelerating the rate of electrical development. The electrical industry claims no monopoly of ingenuity or organising talent, but it has sufficient within the ranks of its existing associations to enable it to use electrical money to the best popularisation effect for electrical manufacturers, traders, supply authorities, and contractors.

All of the foregoing reflections seem to point very definitely to the need, already alluded to here and elsewhere, for a big concentrated effort of the industry in which so many hundreds of millions of pounds are invested. Through the medium of E.D.A., which did so magnificently at Wembley last year and equally admirably on a smaller scale at Olympia last month, this can be done if the substantial resources can be guaranteed. The organisation whose annual meeting, by the way, is announced for Friday, April 17th, is now rich in experience, and it is so constituted that it should be able discreetly to secure co-ordination which would obviate overlapping and other evils without putting a brake on legitimate effort and enterprise.

---

**The Registration of Electrical Contractors.**

Some particulars of the progress that has been made with the National Register of Electrical Installation Contractors were placed before the annual meeting of the Board held last Friday.

The Executive Committee, the constitution of which was fully set out in our issues of February 8th and July 25th, 1924, showed that down to the date of its last meeting 728 applications for registration had been received; 670 of the applicants had been approved, and to these certificates either had been or were being issued, while 46 had been declined or withdrawn, leaving twelve under consideration. Six municipal authorities had issued notification to the effect that tenders from Registered Contractors only would be considered, and in some other cases engineers desired to give approval to the National Register, but were awaiting the instructions of their authorities. The subject of the more or less limited publicity which the movement has received having been raised in some quarters, the Executive mentioned the publication of the first lengthy list of registrations which was given in our pages and those of one other electrical journal free of charge. It defended itself against critics who have made their statements on the erroneous assumption "that the Register is a trade organisation which exists for the benefit of its members only, and has practically unlimited resources to spend on advertising." The primary object of the Register was to afford to the public the means of distinguishing electrical installation contractors who had given evidence of their competency, and the Executive believed that the best course for reaching the proper people was regularly to circularise supply engineers, consultants, and architects who intervened between the installation contractor and the ultimate purchaser; to publish names in the electrical Press; and to

rely upon the installation contractors making known when tendering that they possessed the hall-mark of registration.

One of the most gratifying features to the Executive is found in the fact that practically the whole of the leading installation contracting firms of the highest standing applied for admission at the outset. This is regarded as a source of great strength to the movement, and it has been largely responsible for the preference "that is already apparent on the part of purchasers to place orders with contractors on the Register, even in some cases at a higher price." The pressure that such a tendency will have upon other eligible contractors is regarded as only a matter of time. The Executive invites any of the registered 670 to forward names of others who are thought eligible to come within the circle, and a complete list of all the contractors in the country is to be prepared so that the benefits of registration may be placed before them. As indicating that the work of the Board is no small detail, it may be mentioned that the third printed list of registered names which is now in preparation will be issued to about 10,000 addresses. The next group to be circularised will be the builders, who will be written to individually setting forth the advantages of electrical registration. With the co-operation of the I.E.E., the E.C.A., and the I.M.E.A., some 107 local advisory committees are being formed; 67 are already complete. It goes without saying that a vast amount of detail work has also had to be done in getting the movement started. Those who have devoted so much thought and time to the object merit only gratitude and praise for the substantial progress that has been made.

A sad note in the Committee's account of its stewardship is the reference to the loss sustained by the Board by the death of its first chairman, Mr. C. H. Wordingham, one of the most active participants in the initiation of the scheme, and one of its most vigorous supporters. He is followed in the chair by Mr. P. V. Hunter, who (with the support of Mr. A. H. Dykes as vice-chairman) we may be sure will not be lacking either in active participation in the extension of the movement or in vigorous support of its ideals for raising the standard of electrical contracting work and the prestige of the industry.

---

**Electric Cooking Problems.**

The paper by Mr. R. Hardie, of the Glasgow Corporation Electricity Department, upon this subject, which is abstracted in this issue, is a well-informed statement of the present position of the electric cooking business.

The convenience and hygiene of electric cooking have been established beyond question, and yet the electric cooker, except in a few favoured districts, is not so common as it should be.

Conservatism is probably the greatest obstacle to progress, and it is manifested not only by the public, but by those to whom we look for a more enlightened attitude—the suppliers of electricity and electrical apparatus. The public cannot be blamed if, through lack of educational propaganda, they continue the use of the coal fire and the gas cooker, and less apathy on the part of many supply authorities is greatly to be desired. The high cost of the apparatus is used by some as a justification for this apathy, but they might help the cause and their own undertakings if they gave close thought to the reasons for high cost and brought pressure to bear in the right quarters until prices were lowered. If they are waiting for the perfect electric cooker, as Mr. Hardie suggests many of them are, their apathy is precisely the best means of deferring that desirable consummation; no cooker is perfect, but progress towards the ideal is aided by making the best use of what is available.

The cost of apparatus is certainly a serious handicap, and hiring schemes are rendered far too burdensome to some supply undertakings. Yet practical experience shows that under the "Service" arrangements of some undertakings the hiring out and maintenance of cookers brings the staff of the department in close touch with the consumer's daily requirements, and produces excellent suggestions for improvements in the apparatus. As Mr. Hardie points out, the high cost imposes a limit upon the number of cookers which any one undertaking can carry at one time. He suggests that at present the manufacture of electric cookers is merely a side line with most firms, and it is this piecemeal production which accounts for their high cost, as compared with gas cookers.

The remedy might be found in mass production in one or two works, but these would probably require to have a market already made before they would commence operations. We believe that with the co-operation of a number of suppliers of electricity, this could be arranged. Perhaps a conference between such undertakings and manufacturers of domestic electrical apparatus would be worth while.

We are convinced that the desire to cook electrically is existent in a large measure among the people, and a little more knowledge and the availability of facilities will soon convert desire into action.

Glasgow finds electrical cooking a remunerative business, and in many centres all over the country evidence is available to show that the public is awakening to the benefits of electricity in the home.

---

**Standard Method of Boiler Testing.**

The outcome, so far, of the labours of the Committee representing eleven leading institutions and associations, which is endeavouring to ensure that boiler tests shall be both accurate and comparable, is the appearance of two draft forms for the tabulation of results. The first of these, devised for "comprehensive" tests, contains 227 items, and the second, for "commercial" tests, comprises 185 items to be filled in, but many of these are, of course, not applicable to every boiler, as different methods of firing, &c., have to be provided for. The draft forms were submitted for criticism at a joint meeting, held at the Institution of Civil Engineers on March 25th, when the attendance was disappointingly small in view of the importance of the subject. Several of the emendations proposed deserved the serious consideration of the Committee, but it is quite clear that the real conflict of opinion will rage, not so much around the data to be collected as around the methods to be adopted for getting them. One speaker, for example, pleaded earnestly that weighing the feed-water was the only safe and proper thing to do, while another, with more justification we think, argued that when anything up to a hundred tons of water per hour had to be dealt with, the errors of a properly calibrated Venturi meter were likely to be less than those arising from weighing.

We sincerely hope that the Committee will take a common-sense view of testing operations, and will realise that absolute accuracy being unattainable, what is wanted is the simplest, cheapest, and most practicable method which will give results within a known degree of error. No boiler test result is more reliable than the calorific value of the coal burnt, and if one gets half-a-dozen different chemists to take samples from the bulk and compares the calorific values they will severally obtain, he will get some idea of the inevitable uncertainty surrounding the most important factor in a boiler test. Any stipulation of the Committee which will make commercial boiler testing more than necessarily difficult or expensive will be deplorable. It is far better that a hundred tests should be made with a "probable error" of two per cent., than that a few only should be made with an attempt at greater accuracy. Ultra-refinement of methods in such a matter as boiler testing is likely to lead to a false sense of security with regard to the results. In this, as in other instances, the old statement holds good that "a man who deceives others is a knave, but he who deceives himself is a fool." The Committee might, we think, give a list of approved *types* of instruments with recommendations as to the conditions under which each type could be properly used, and if such instruments were calibrated previously and subsequent to a test, their readings should be accepted as commercially accurate.

# Voltage Regulation by Static Transformers.

## New Apparatus for the New Conditions created by Linking Power Stations.

By G. RATTENBURY.

REGULATION of voltage on alternating-current systems has become increasingly important as the size of networks increases and as linking-up between power stations becomes more common. Busbar regulation does not meet all the requirements, and other methods become necessary. Static transformers can be utilised for this purpose, the transformation ratio being varied, either

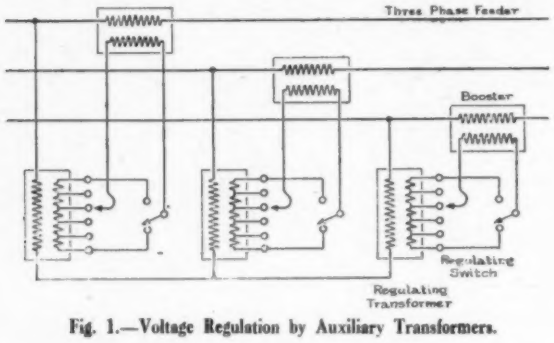


Fig. 1.—Voltage Regulation by Auxiliary Transformers.

by altering the geometrical position of the windings relatively to each other (induction regulators), or by altering the ratio of the primary to the secondary turns.

Induction regulators permit of exact adjustment of voltage under load with the minimum of switchgear, but have the disadvantages of:—

Lower power factor.

Alteration of phase angle, causing difficulty if several such regulators are provided on different feeders supplying a common network.

Serious mechanical stresses set up in the regulator by short circuits in the network.

Increased cost of transformers.

These disadvantages can be avoided by providing ordinary transformers with tappings, which permit of voltage regulation by definite steps only.

The requisite connections to the tappings can be made either by:—

1. Links inside the transformer tank.

2. Switches designed for use under open circuit conditions only.

3. Switches designed for frequent operation under load.

A fairly simple type of switch can be designed for use under open circuit conditions and can be accommodated in the transformer tank and operated by a handle from the outside. Such a switch, however, is serviceable only to deal with seasonal changes or with progressive increases of the load. The same remarks apply, with even greater force, to links inside the transformer tank.

It is proposed to consider briefly the more difficult problem of dealing with daily or hourly variations of voltage, for which it is essential to be able to change from one tapping to another without opening circuit and without ever short-circuiting transformer sections. The multiple-way regulating switch for this purpose must, like a battery-regulating switch, be provided with a pilot brush and buffer resistance (or choking coil), the latter being momentarily connected across one section of the transformer as the regulator moves from step to step.

To reduce to a reasonable amount the voltage surge caused by changing from one tapping to another, the buffer circuit must carry a current of the same order as the full-load current in the main circuit, with the result that a certain amount of arcing is inevitable when that circuit is opened. The regulating switch may be frequently used, and it is impracticable to enclose it in the transformer tank because of the deterioration of the oil which would be caused by the arcing. It is, therefore, best to make the regulator an entirely separate unit in order to obtain the most satisfactory design possible from the switchgear point of view.

Such regulators can be connected to transformers in a variety of ways. The most obvious method is to provide tappings on the primary or secondary windings of a step-up or step-down transformer. Alternatively, auto-transformers can be connected across the mains, suitable voltage tappings being provided for connecting to the regulators.

A third method, possessing several advantages, is shown diagrammatically in fig. 1, from which it will be seen that the regulation is effected by pairs of auxiliary transformers of comparatively small size, one of each pair being provided with tappings giving a variable voltage, which, by means of the second or booster transformer, can be impressed on the line. The great advantage of this arrangement is that, provided the requisite volt-amperes are obtained, the current and voltage of the local circuit can be selected to suit the switch design, and are not determined by the voltage of the system. This feature is particularly useful

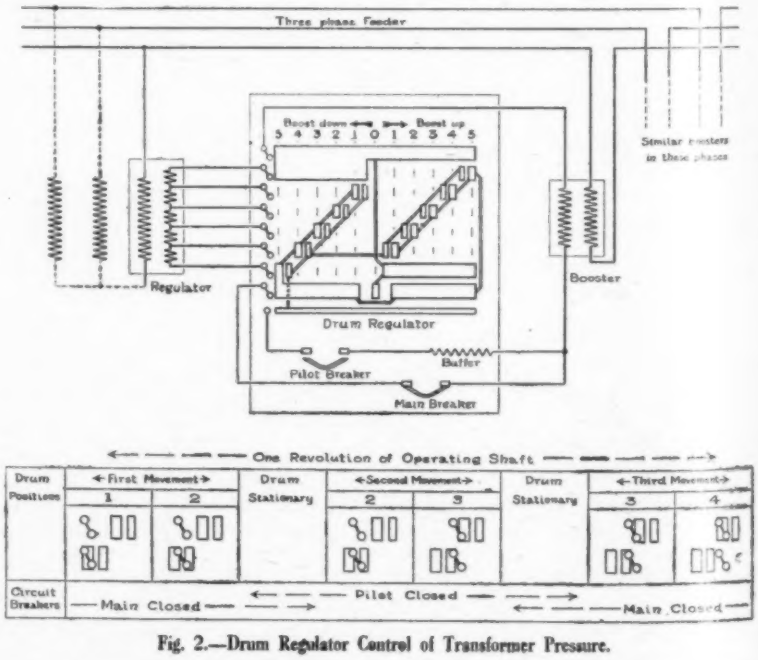


Fig. 2.—Drum Regulator Control of Transformer Pressure.

when regulating on extra-high-pressure links between power stations, as it permits the regulating switch to be isolated from the e.h.p. supply and to be designed to deal with only a moderate voltage.

The selection of a suitable value for the local circuit is determined mainly by the following considerations. First, the multiple-way switch and the necessary

cables for connecting it to the transformer tappings would become unwieldy if the current exceeded 250 to 300 amperes. Secondly, consideration must be given to the reduction of hysteresis losses in iron transformer and switch casings if the current exceeds 300 amperes. Consequently, it is found convenient to limit the current in the local circuit to about 250 amperes, increasing the voltage of the regulating transformers as required to give the desired volt-amperes.

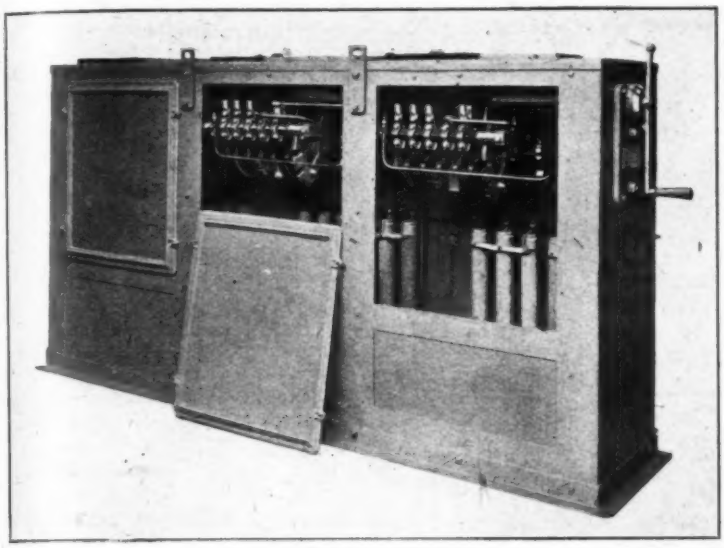

Fig. 3.—Ironclad Air-break Regulator.

The number of regulating positions required depends upon the voltage variation to be compensated for in any particular instance and the permissible coarseness of the steps; but eleven steps are usually sufficient, and, with the above-described system of connections, can be obtained with a five-section transformer and a regulator giving five positive and five negative boosting positions in addition to the central zero boost position.

The robustness and reliability of drum-type switchgear makes it particularly suitable for this service, and a drum of reasonable dimensions can be designed to fulfil the requirements mentioned above.

The conditions under which such regulators are likely to be used can be divided roughly into two classes:—

1. Regulating the voltage at the extremity of an isolated feeder, when usually only a moderate amount of power has to be handled and air-break switchgear can be used, the voltage being low.

2. Regulating the transmission of power along a connecting link between two power stations, when a much larger amount of power has to be dealt with and oil-immersed switchgear is desirable to handle safely the higher voltage necessary if the above-mentioned current is not to be exceeded.

Considering the case of a transmission line dealing with 12,000 kVA requiring a 10 per cent. regulation up and down, with the connections shown in fig. 1, each regulating transformer has to provide $1/\sqrt{3}$ of the maximum voltage regulation between phases. Consequently, each transformer has to deal with:—

$$\frac{12,000}{10\times\sqrt{3}}=700 \text{ kVA.}$$

If the current in the local circuit is fixed at 250 amperes, the maximum boost per phase would be:—

$$\frac{700\times1,000}{250}=2,800 \text{ volts.}$$

Thus, switchgear designed for a maximum of 3,000 volts to earth should suffice for most requirements.

Burning of the drum contacts, if long continued, might ultimately result in the breaking of the main circuit when changing from one tapping to the next, so that when the voltage per section exceeds about 20 it is desirable to provide circuit breakers, connected in series with the main and pilot fingers on the drum and operated mechanically in synchronism with the drum in such a way that the circuit will always be made and broken on them and not on the drum. Fig. 2 shows the connections of a regulator of this type, the scheme being essentially the same as shown in fig. 1, and fig. 3 illustrates an ironclad air-break regulator in which the proper movement of the circuit breakers is obtained by cams on the operating shaft, while the drum is operated from the same shaft by a pin-and-slot gear in such a way that the drum is always stationary while the circuit breakers are operating and *vice versa*. Each revolution of the operating shaft effects a switch movement from one tapping to the next, the sequence of operations being illustrated in the lower part of fig. 2, from which it will be seen that the changeover from one tapping to the next is effected while the circuit is completed through the pilot circuit breaker and the buffer, and that the particular transformer section is only momentarily short circuited through the buffer while the drum is stationary in position 3. It is important that the regulator should not be left in this intermediate position, and notching gear is connected to the handle to indicate to the operator the correct running positions.

Air-break switchgear of this type is suitable for transformers giving up to 120 volts per step, *i.e.*, 600 volts total. For higher voltages it is preferable to have the drum and circuit breakers immersed in an oil tank, see fig. 4, which illustrates a single-phase

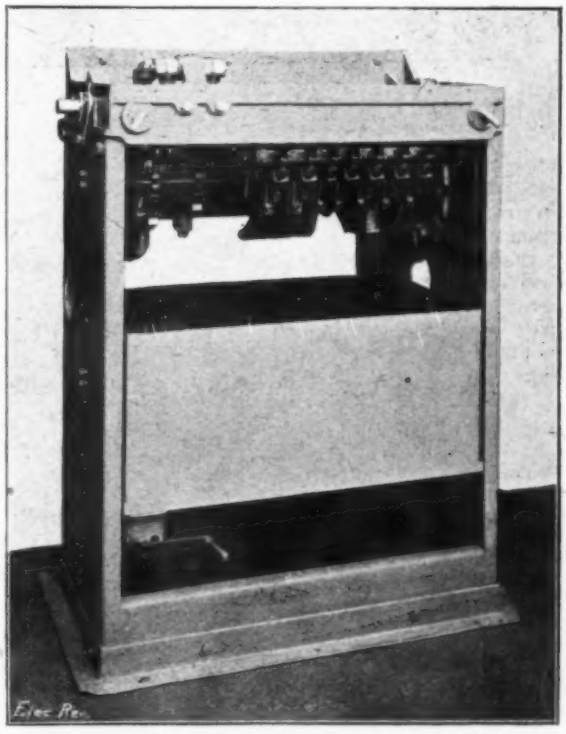

Fig. 4.—Oil-switch Regulator for 3,000 V Max. Variation.

unit suitable for a transformer giving a maximum boost of 3,000 volts up or down.

With switchgear of the air-break type, it is possible to enclose the requisite resistance for the buffer circuit in the lower part of the pillar-type case. For switchgear of greater capacity the resistance becomes unduly

large, and is preferably replaced by a choking coil in a separate oil tank.

The connections between the transformer and the regulator, being rather heavy and numerous, should be as short as possible. The regulator can sometimes be fixed on the outside of the transformer tank; but in larger sizes this is inconvenient owing to the space occupied by the oil-cooling pipes, and the regulators are preferably fixed independently either immediately in front of the transformers or in a gallery above them.

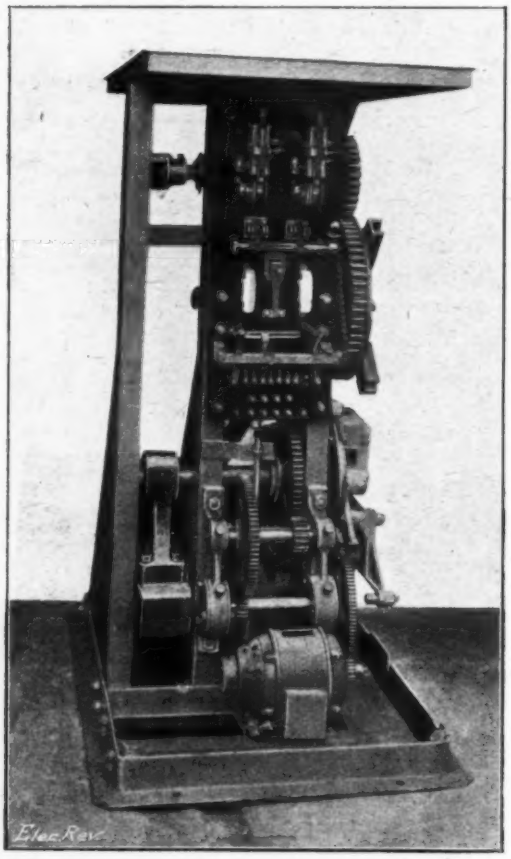

Fig. 5.—Mechanism of Control Pillar.

Such positions are frequently not very accessible, and if it is impracticable to arrange shafting to operate the regulators from the control switchboard it becomes necessary to provide the regulators with motor-operating gear which can be controlled by push button from any distance. Fig. 6 illustrates three single-phase oil-immersed units, connected by shafts with universal joints, to each other and to a pillar containing the necessary gearing, the motor, and the switches for controlling the auxiliary circuits.

To prevent any possibility of the regulator being left in an intermediate position due to a failure of the supply to the auxiliary motor, caused by the blowing of a fuse or otherwise, it is desirable to operate the regulator by a weight or spring, which is wound up by the motor before the movement of the regulator commences, and which will then carry the regulator with certainty through a complete movement from one tapping to the next, even if the supply to the motor fails. The motor-operating pillar shown in fig. 6 is provided, as shown in detail in fig. 5, with a swinging weight, lifted by the motor and operating the regulator when falling. By means of an intermittent gear this same action is obtained in both directions of rotation.

A panel mounted on the front of the motor-operating pillar carries electrically-operated reversing contactors for controlling the direction of rotation of the motor, a cut-off switch for stopping it at the end of each separate movement of the regulator, limit switches to prevent overrunning when the last tapping is reached, and a double-pole isolating switch and fuses. (In the particular panel illustrated, direct current supply was available for the operating motor but, where necessary, a 3-phase supply may be used instead.)

This motor-operating pillar is controlled by two push buttons on the control switchboard, one for each direction of movement of the regulator, and the contactor closing coil connections are so arranged that once either of the push buttons has been pressed, the motor will continue to run until one movement of the regulator has been completed.

A means of indicating on the control switchboard the position of the regulator is necessary, and the simplest device consists of a series of lamps behind a suitably numbered opal glass dial, connected by a multi-core cable to a multiple-way auxiliary switch driven from the motor-operating gear. If the control point is at such a distance as to make a multi-core cable impracticable (*e.g.*, if the regulator is in an unattended sub-station and controlled from another sub-station or power station), an instrument of the ohmmeter type makes perhaps the most satisfactory arrangement. This is connected by two leads to a resistance in the motor-operating panel, and the ohmic value of this resistance is regulated by the multiple-way switch driven from the motor-operating gear, the ohmmeter dial being numbered accordingly instead of being calibrated in ohms. (A low-reading ammeter could, of course, be used in a similar way, but would be affected by any variations in the voltage used for operating it.)

The system of control described above is suitable wherever an operator is available, but it is sometimes desirable to have regulators in unattended sub-stations, and automatic voltage control then becomes necessary. It is a comparatively simple matter to substitute for the push buttons a voltage relay designed to bring the motor-operating gear into action if the voltage rises or falls a predetermined amount above or below normal. Such a relay can be designed to give regulation, if necessary, within 2 per cent. up or down, and can, if desired, be compounded by a current coil to compensate for line drop so as to give constant voltage at any desired distance from the point at which it is connected. A time delay relay of fairly long period should be provided to eliminate the effect of momentary voltage fluctuations.

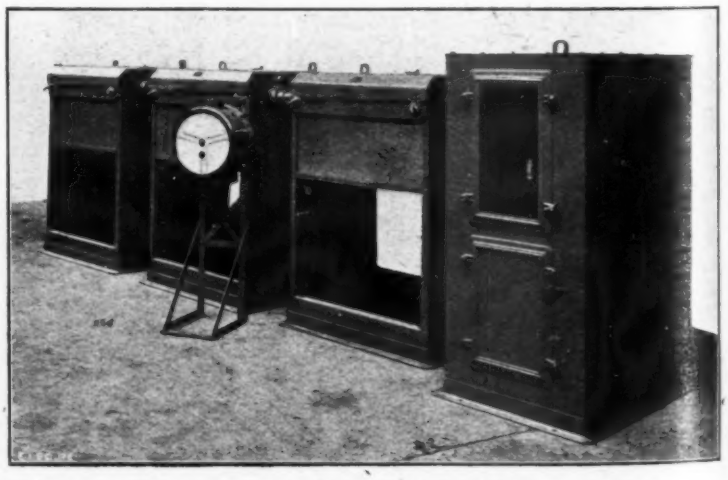

Fig. 6.—Regulating Units and Control Pillar.

The switchgear described above may appear complicated, but it very greatly facilitates the satisfactory regulation of the voltage on large systems or the distribution of load between power stations running in parallel. The cost of the apparatus can be recouped, at the least, by the possibility of loading cables up to their maximum capacity as determined by heating, and ignoring voltage drop.

The regulators illustrated are manufactured by Messrs. Brookhirst Switchgear, Ltd., Chester, to whom acknowledgments are due for their courtesy in permitting the publication of the above information and for providing photographs.

# Combining Gas and Electricity Production.

## A Review of the Economies which might be effected by Co-operation.

By G. M. GILL, M.I.Mech.E., M.I.Gas E.

THERE are undoubtedly a good many people in the gas and electrical industries who think that there are great possibilities in combining the production of the two commodities. The object of this article is to put before electrical engineers some aspects of the case which may possibly be new to them, and likely to create additional interest in the direction of exploring the possibilities to which reference has already been made.

Until such combinations are actually tried on a large scale, there is no incentive to consider the question at all thoroughly, and no definite progress can be made until some pioneer spirit determines to run the two operations on a large scale in one works.

The gas manufacturing process is a highly efficient one with, however, great possibilities of further improvement, but such improvements could the more readily be achieved by combination with electricity generating stations.

The thermal efficiency of the gas-making process is evident from the following approximate figures, which represent average conditions in England:—

| | |
|---|---|
| 1 ton of coal used, at 12,946 B.th.u. per lb. ... ... | 29,000,000 B.th.u. |
| Products available for sale per ton of coal— | |
| ½ ton coke, at 11,000 B.th.u. per lb. ... 12,320,000 | |
| 66 therms of gas 6,600,000 | |
| 10 gal. of tar ... 1,725,000 | |
| 2½ lb. sulphate of ammonia and 40 lb. sulphuric acid from sulphur produced— no heating value ... ... | 20,645,000.* |
| Used in the process of gas manufacture for carbonising coal, including steam raising to provide power, and losses in gas distribution ... | 8,355,000,* or a heat efficiency of 71.0 per cent.* |

*By recovering the waste heat by the two systems mentioned in this article, and assuming the production of 1,850 lb. steam available for use per ton of coal carbonised, the corresponding figures would be 23,550,000, 5,450,000, and 81.2 per cent. respectively.

An efficiency of 71 per cent. could be materially increased if there were a good outlet for the coke, coke breeze, pan breeze, and waste heat produced in the process. At times coke sells very well, but it is an undoubted difficulty to dispose of it at good prices in many parts of the country. It is customary to use the coke breeze and pan breeze—the fuel extracted from the furnace ashes—in boilers for steam raising for providing power for operating the plant.

Waste heat can be recovered in two ways, one in extracting the heat from the products of combustion as these pass away from the retort settings to the chimney, and the other in extracting the heat from the coke as it is discharged from the retorts (horizontal type only). The former source of waste heat has been proved on a large scale in many gas works, probably in 50 to 100 works in Great Britain alone. The latter system is in use in several works on the Continent.

As regards the quantity of waste heat in the products of combustion in the retort settings, this in most gas works, whether it be modern or old-fashioned plant, will be sufficient to evaporate from 1,000 to 1,500 lb. of water per ton of coal carbonised, while the temperature of such products is likely to range from 450 deg. C. to 850 deg. C. on the inlet to the waste heat boiler, thus providing for any reasonable requirements in pressure and superheat.

In works having horizontal retorts—and roughly half the gas works in this country use horizontal retorts—the coke is discharged at a high temperature, and its heat can be converted into steam in a practical manner in a process known as the Sulzer dry cooling system.

The amount of water to be evaporated in this way is stated to be from 700-900 lb. per ton of coal carbonised.

Thus, with horizontal retorts the waste heat should produce per ton of coal:—

| | |
|---|---|
| From products of combustion | 1,000 to 1,500 lb. of steam. |
| From hot coke ... ... ... | 700 to 900 ,, |
| | 1,700 to 2,400 |
| Less 10 per cent. for power ... | 170 to 240 |
| Available for use .. | 1,530 to 2,160 ,, |

With vertical retorts the heat in the coke is already utilised for heating the air used for combustion, and therefore is not available, but partly for this reason the heat efficiency of the vertical retort system is frequently higher than it is in horizontal retort settings.

There is plenty of evidence to show that with a large modern gasworks carbonising plant the above figure of 71.0 per cent. can be increased to 83 per cent., the balance of 17 per cent. being used to carbonise the coal and to provide power for working the plant; the latter is produced by coke breeze and recovered coke from furnace ashes, the heat value of these low-grade fuels not being included in the above figures.

For its own power requirements a gasworks is likely to use anything from 400 to 1,500 lb. of steam per ton of coal carbonised. Some small gasworks use no steam, all power being provided by gas engines. The smaller the gasworks the less, proportionately, is the amount of power used per ton of coal carbonised, as so many operations are carried out by manual labour, but the waste heat in the small gasworks may be too small in the aggregate to be worth recovering. It is, therefore, difficult to lay down any hard and fast rule for their requirements in this respect.

It is probable that with a gasworks and electricity generating station on the same site and run under the same management, the power for the former would be provided by electric motors, and all waste heat and such solid fuel as was required would be used for the production of steam in the electric generating plant.

A promising process for the combined production of gas and electricity has been in operation in the United States on an experimental scale. In this process coal is first pulverised and is then carbonised in a vertical retort to produce gas, tar, and coke dust. The latter is used as a pulverised fuel for steam raising, the tar is distilled, the gas is stripped of motor spirit, and is then heated to a high temperature in a regenerator built

into the side walls of the boiler setting. This highly-heated gas is used for carbonising the powdered coal by direct contact in the vertical retort, in which the coal passes downwards, and the gas upwards, the carbonisation being instantaneous.

The writer, who is leaving shortly for the United States, hopes while he is there to learn more of this process, which has undoubted possibilities.

It should be explained that the whole of the steam which can be produced from waste heat is available for the generation of electricity, provided that gasworks continue to use breeze and coke for their own steam requirements. Should the gasworks use the steam from the waste heat there would then be available for sale the breeze made, and some additional amount of coke in many cases, and frequently also a good deal of steam made from waste heat, but not required for gasworks purposes.

The whole matter is somewhat complex, and to get the actual state of affairs each case must be investigated on its merits, but there is undoubtedly in all cases a considerable potential economy.

The advantages of placing gas and electricity generating plant on the same site are not confined to fuel economies. Both classes of works require draughtsmen, clerks, timekeepers, engine fitters and turners, carpenters, pattern-makers, smiths, and other classes of mechanics, motor-drivers and carmen, storekeepers, &c., and works facilities such as jetties, wharves, workshops, offices, lobbies, weighbridges, lorries, motors, vans and horses; and it would seem that there is everything to gain by providing for the dual use of men and plant.

# A Visit to the Chloride Accumulator Works.

### Record of Works Extension and Progress.

Always complete, but never completed, the works of the Chloride Electrical Storage Co., Ltd., at Clifton Junction, are backed by a record of progress, which, especially during the last fifteen months, is surprising. The output during the year 1923-1924 was almost equivalent to the total business done during the three previous decades, starting from 1893 when the company commenced activities. Even this splendid achievement looks like being surpassed; the works are on full production and have good orders in hand, necessitating further extensions to the works. Six new sheds, each 150 ft. long, are now being built; two of them are for joiners' machine shops, bench work, &c., two for dealing with wood separators, one for packing motor car-starting batteries and similar work, and one for forming plates. Another shed is being erected for batteries in celluloid boxes. With the new buildings in use, the old joiners' shop will be demolished and a new pasting department of four sheds will give further room elsewhere for bigger premises for casting.

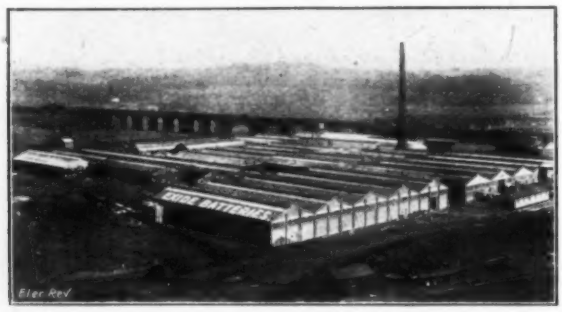


Fig. 1.—The Chloride Battery Works.

The works (of which fig. 1 is an exterior view, illustrating the growth that has taken place since they were described in our February 27th, 1920, issue) now consist of about 50 sheds, and batteries of all types and sizes for manifold purposes are manufactured.

There is a big demand for large-capacity storage batteries, especially for railway electrification schemes. The latest achievement of the Chloride Co. has been to provide batteries for the Great Indian Peninsula Railway Company's electrification scheme at Bombay, which was recently described in our pages. The company has also recently received orders for 21 batteries to be used in the sub-stations of the Southern Railway. The scheme this railway is carrying out is claimed to be the largest enterprise of the kind yet attempted.

The increasing number of automatic telephone exchanges is a tribute to the increased efficiency of the modern storage battery; the Chloride batteries at the Holborn and Bishopsgate exchanges and at big centres in the provinces are nearly of the magnitude of the large central station batteries used for power purposes. One of the batteries for the Holborn exchange was on view at the works, of 10,000 ampere-hours capacity. Another very large set was for a submarine. Reliable batteries are the secret of the success of the electrically-propelled vehicle, and at Clifton Junction a generous use is made of electric trucks for inter-department transport, and of large vehicles for general delivery service. The company supplies batteries under contract to some of the leading motor-car manufacturers, including Messrs. Ford.

The greatest advance Exide batteries have made has been in the field of wireless development, and many of the stations in different countries are equipped with them; the British Broadcasting Co. uses them. Wireless has demanded a range of batteries previously uncalled for—work was started in a small corrugated iron shed, but to-day the weekly output runs to many thousands of cells in celluloid cases alone, in addition to large quantities in glass boxes.

As the largest manufacturer of accumulators in the British Empire, the Chloride Co. has organised a service of nearly 7,000 agencies throughout the world and in the United Kingdom there are 450 "service" stations (see Elec. Rev., February 24th, 1922). Radio development has presented further opportunities of rendering the public "service."

The works at Clifton Junction have all the amenities that make life pleasant and agreeable for employés; well-cooked food is provided at moderate prices in spacious rooms, all done by electricity. Playing fields, tennis courts, bowling greens, are close to the premises, and various societies form part of the social structure of the staff. Recently the company inaugurated a pension scheme which will be of great benefit to the workers when they retire.

Following the inspection of the works, the visitors were entertained to luncheon in Manchester, and

Mr. W. S. Naylor, general manager, mentioned that the works never seemed to reach the finished stage. No sooner was one extension completed than the necessity for building others was forced upon them. While they maintained the output of quality products, he supposed they could not help expanding. To the social and welfare side of the works they attached a great deal of importance; people liked to deal with the firm that was keenly interested in the affairs of its employés, quite apart from actual business. The service roll contained the names of those employés who had over 25 years' service to their credit. They had 30 of them at the works and on completing that period of service the employé received a gift of £100. The works had an employés' fund to which amounts were voted every year by the shareholders. A considerable part of this money was spent in recreation, and in recent years they had laid out sports fields, and there was the general social section; still another important social side of the works activity dealt with employés requiring special assistance during illness. If a man were off work three or four months, there was a works fund from which assistance could be granted him to tide him over the period of want. Everything possible was done to eliminate the possibility of lead poisoning in the processes of manufacture and if any man did become affected, he was carefully looked after. Patients were sent away for a few weeks to places like Southport. He could not remember a fatal case of lead poisoning at the works during its 30 years' existence. Still another branch of activity was the sick club, to which every

Fig. 2.—Manufacture of Rosettes.

employé at the works made a weekly contribution which was supplemented by a contribution made by the works. The management was concerned about the technical education of the young people employed both in the offices and in the works, and for some years a scheme had been in operation whereby monthly reports were received from the evening schools to which students became attached at the commencement of the session. At the end of the session a grant was made and this often covered fees and the books required. Thus, the worker obtained his education free. There were two libraries at the works. Another useful feature of their organisation was the Works Committee, which had been in existence for about seven years and by means of which possibilities of friction were eliminated. He was a strong believer in the usefulness of the Works Committee.

MR. E. A. GATEHOUSE, on behalf of the electrical and general Press, toasted the Company.

MR. STEVENSON, assistant sales manager, replying, said that the nucleus of the pension fund was £32,000, all of which was voted by the shareholders.

## Parliamentary.

[By Our Special Parliamentary Reporter.]

**London Electricity Supply Bills.** — When the House of Commons Committee dealing with these Bills resumed its sitting on March 24th,

SIR LYNDEN MACASSEY, K.C., presented the case in opposition of the Corporation of the City of London. He said that the Corporation feared that the lighting consumers, who were the largest body of electricity consumers in the City, would be adversely affected by the companies' scheme. Moreover, no information whatever had been given to the Committee regarding the proposed Joint Electricity Authority by the Electricity Commissioners. The Bill proposed to fix a state of affairs until 1971 without the whole of the scheme being placed before the Committee. A similar Bill, that of the Yorkshire Electric Power Co., which was also bound up with the formation of a Joint Electricity Authority, had been rejected by a House of Lords Committee last session for a similar reason. The proposed London authority would have no powers in the portions of the area which were supplied by the power companies. The technical scheme to which reference had been made was now merely a permissive scheme, although it was originally obligatory, and in effect it had ceased to exist. The City Corporation was against piecemeal legislation dealing with such a vast subject as electricity supply in Greater London. The Corporation could not concur in the idea that because an agreement had been made between the L.C.C. and the companies Parliament should sanction it. The scheme provided for the maintenance of very high dividends; it was an inconvenient scheme, and the interests of the consumer were apt to be overlooked.

Sir HARRY HAWARD (representing the Electricity Commissioners) said that the Commissioners looked upon the Bill as a necessary supplement to the Order which they had made delimiting the Greater London area. The Commissioners could not do all that they required to do in the Order by itself. For instance, it was impossible to repeal the purchasing powers of certain authorities. Witness contended that it was largely on the representations of Sir Lynden Macassey (for the City Corporation), at an inquiry held by the Commissioners, that the technical scheme was made permissive, and now Sir Lynden Macassey said that the scheme and Order generally were weak. If the Commissioners had had their way, the technical scheme would have been made compulsory, but they were threatened with being taken to the Courts. As they wanted to get on and do something, the technical scheme was made permissive. Without such an agreement as that between the L.C.C. and the companies, there could not be a concentration of the generation of electricity in London; the agreement was in the public interests, and was an important step forward. When the Order was sanctioned by Parliament, the Commissioners would apply themselves to the settling of fair standard charges to consumers.

In reply to questions, SIR HARRY HAWARD said that if the Bills did not pass, the Commissioners' Order would have to be modified. As to the purchase of the undertakings by the L.C.C. in 1931, there was nothing before the Commissioners to indicate that the L.C.C. was ever minded to give notice of its intention to proceed with the purchase.

Evidence was then given by Mr. W. B. Keen, C.A., on behalf of the City Corporation.

Under cross-examination by the Hon. Evan Charteris, K.C., on March 25th, Mr. KEEN said that the companies had charged unduly high prices to the consumers whereby they had been able to pay unduly high dividends and to accumulate unduly large reserves. He had confidence in the Electricity Commissioners, but not to the extent of abandoning to them all the existing powers of the Corporation to watch and protect the interests of its constituents. There was too much of a tendency to leave everything to the Commissioners.

Having ascertained from witness that the Corporation merely desired that the Bills should not be allowed to proceed, counsel asked whether the Corporation had an alternative scheme to put forward. Mr. Keen said he had not been instructed to put forward an alternative scheme, but merely to criticise the scheme in the Bill. The elaborate scheme suggested was not necessary in order to obtain an apparently trifling saving in cost of generation. Cross-examined with regard to the tables put in by Sir William Plender, he said he regarded them as absolutely valueless, because they did not take into consideration the capitalised reserves. If these capitalised reserves meant another 7 per cent. dividend, it was a very material circumstance. In reply to a further question as to the probable transfer of this scheme, after 1931, to a public authority (assuming the Bill were passed) he said that the scheme was so inextricably bound up with the idea of the transfer in 1971 that it would be almost impossible to conceive of a Bill being brought forward before then for the transfer of any of these undertakings to a public authority.

Mr. F. W. PURSE (engineer and manager of the West Ham Electricity Department) gave evidence with regard to the sliding scale as proposed in the Bill to show that the consumers would not receive the benefits which the promoters contended they would receive by the system of averaging.

Mr. EDWARD MACASSEY (counsel for the Poplar Borough Council) asked the Committee to insert a clause requiring that the promoting company should not be authorised to supply electricity to the Port of London Authority in respect of docks and railways in the Poplar area.

Mr. CRAIG HENDERSON (for the Port of London Authority) asked that they should be allowed to take their supply from the best and cheapest source.

The Hon. EVAN CHARTERIS, K.C. (for the promoters) claimed that the Bill carried out the policy of Parliament as embodied in the Electricity Supply Acts of 1919 and 1922. It was those two Acts which had made this Bill possible. As to the opposition of the City of London Corporation, he said that the London and Home Counties district scheduled by the Commissioners had a population of 8¼ millions, whereas the population of the City was 13,000. The organisations representing those 8¼ millions were satisfied with the terms of the scheme. The City Corporation had never, from beginning to end, contributed one ray of enlightenment to the subject. If the Corporation had wished to further the solution of this difficulty which had beset London for 25 years, it should have taken the opportunity of putting forward, with the other responsible bodies in London, a scheme to deal with it.

On March 26th counsel concluded his final speech for the promoters, and laid emphasis on the evidence of Sir William Plender and Mr. Cash, two accountants, that in their opinions there was very strong doubt whether the price which would have to be paid in 1931 under the terms of the Electric Lighting Act of 1888 would not be more than that arranged between the London County Council and the companies. In 1931 the standard price was recalculated automatically on the then costs of production, and, in any case, a lower dividend would be paid after 1931, *viz.*, 7 per cent. over all. One point which had not been emphasised sufficiently was that the dividends paid by most of the companies since 1922 had been increasing, and at present the consumers were paying a larger sum of money in dividends to the companies than they would under the Bill. Finally, the costly arbitrations which would be necessary if the London County Council were to purchase in 1931 would be avoided.

The CHAIRMAN asked whether, supposing the companies were purchased in 1931, the money awarded after arbitration would be used for meeting liabilities and paying out the shareholders, leaving the reserves as the property of the companies to do as they pleased with.

The Hon. EVAN CHARTERIS, K.C., said that that would be the case. Continuing, he contended that the decision in this case must rest on the ultimate result to the consumer, and the figures showing the reductions in cost, and advantages to consumers under the sliding scale, which had been given by his witnesses, had not been challenged by the opposition.

Counsel then referred to Clause 19, opposed by the Poplar Borough Council, which gives the promoters the right to supply electricity for docks, &c., for use in any part of the area. Although the promoters thought it desirable that the Port of London Authority should have alternative sources of supply, he was prepared to leave the matter in the hands of the Committee.

The CHAIRMAN said the view of the Committee was that rights granted by Parliament could not be taken away without some compensation, and asked if it was not possible to come to some arrangement with Poplar.

The Hon. EVAN CHARTERIS said they would endeavour to, but failing that, he would leave the matter in the hands of the Committee.

Mr. TYLDESLEY JONES, K.C., for the promoters of the No. 1 Bill, asked for the decision on the point to be suspended until his Bill had been heard, as it was raised by several opponents to his Bill. At the same time, he asked the Committee not to give a decision against the No. 2 Bill without hearing the No. 1 Bill, because they were really the two halves of one scheme, and a decision against the No. 2 Bill could also be a decision against the No. 1 Bill without hearing it.

Mr. TINDAL ATKINSON, for the City Corporation, asked that the No. 2 Bill should be decided one way or the other at once in order to save expense to the opponents.

The CHAIRMAN said that the Committee had decided that, subject to arrangements being made to safeguard the interests of Poplar, and to the scheme granting compensation to those

deprived of employment, being satisfactory to the representatives of the employés, the preamble of the Bill would be passed.

The Committee then proceeded to deal with the No. 1 Bill. It was stated that there was no opposition to the preamble, although a number of petitions had been lodged against the Bill. Mr. Tyldesley Jones, K.C., again appeared for the promoters (the City of London Electric Lighting Co., the County of London Electric Supply Co., the South London Electric Supply Corporation, and the South Metropolitan Electric Light and Power Co.), and outlined the provisions of the Bill, describing the Barking station, and the agreement with the London County Council. Subject to certain protective clauses the Committee approved the preamble of the Bill.

**Horley District Gas Co. (Electricity Supply) Bill.**—As briefly mentioned in our last issue, the House of Commons Committee appointed to consider this Bill decided to allow it to proceed. Additional evidence to that already reported was heard on March 23rd and 24th.

Mr. H. J. Randall (a director of the company and engineer and manager of the Yorktown and Blackwater Gas and Electricity Co.) said that the economies obtainable from combining gas and electricity undertakings were particularly prominent in such a case as that under consideration, where the greater part of the electricity load would be lighting which was negligible in the summer. When there was not a large demand, the waste-heat plant could be used, and this would be supplemented by the auxiliary oil or gas plant when necessary. The Yorktown and Blackwater Co. distributed a bulk supply of electricity, and both the electricity and gas loads had increased. In the first two years the costs had been cleared, and in 1924 a profit of 5 per cent. had been made, after allowing 5 per cent. for depreciation. The same staff dealt with both sides of the business, and the gas mechanics had been trained to lay cables and install services. The witness then gave evidence of the growth of the Horley gas undertaking, and contended that the price charged was favourably comparable with the prices charged by neighbouring undertakings. It would not be economical to install further gas-producing plant to utilise the waste heat.

Mr. Tyldesley Jones suggested that the company had ignored the demand which existed for electricity until a local agitation arose, but witness did not agree. Counsel pointed out that there was nothing about electricity in the company's minutes prior to the decision to form a local company. He also said that of the 21 gas companies which had been granted powers to supply electricity, six had had their powers revoked, two had transferred their electricity powers, one had transferred its gas powers, and in one case no supply had been given at all. There were thus only 11 companies supplying both gas and electricity.

Mr. A. Horn (member of the Reigate Urban District Council) thought that Horley would obtain a supply of electricity more quickly if the matter were in the hands of the gas company. His Council had merely resolved not to raise objection to the Electricity Company's proposals. Mr. Tyldesley Jones replied that he understood that formal consent had been given.

This concluded the case for the promoters.

Mr. Tyldesley Jones then addressed the Committee on behalf of the Electricity Co. He said that over £10,000 had been subscribed by local residents, who were prepared to spend much more for the purpose of inaugurating a supply. The Gas Co. first decided to ask for electrical powers after the local agitation in 1922, and it acted in order to defeat that agitation. The company stated in an advertisement in the local Press in February, 1923, that it had applied for these powers, but the statement was untrue and nothing further was done until 1924, when a further public meeting was held. In the meantime the local residents had been negotiating with a London firm with regard to a scheme. The Gas Co. had stated that the matter had been delayed owing to the introduction of Mr. Clarry's Bill, but that Bill was not introduced until May, 1924. The Electricity Commissioners had sent an engineer to make inquiries, and as a result an Order was granted to the Electricity Company. Competition was necessary in places like Horley, where gas companies were apt to be a little slack.

Continuing on March 24th, counsel said that the Bill was merely an attempt to put a restraining hand upon the activities of any electrical undertaking. The prices which the two parties proposed to charge were the same, but whereas the Electricity Co. had an incentive to effect economies and increase business, the Gas Co. had not, for the development of electricity must be to some extent at the expense of gas. The gas charges were on a sliding scale, whereas the electricity charges would not be, and the company would be tempted to raise electricity charges to enable gas more easily to compete. The Gas Co. had spoken of a future bulk supply of electricity from the Southern Railway Co.; this would be an argument for the Gas Co. to delay action if it got powers. The decision to use waste heat was quite a recent suggestion of the company as a weapon with which to meet the present opposition.

Evidence in support of the Electricity Company's scheme was then given by directors of that company, who were local residents, and Mr. C. R. St. John (consulting engineer), who had prepared a scheme for the Electricity Co. He said that a loss was expected in the first year; a profit would not be made until the third year. He proposed the use of oil engines in the absence of a bulk supply, which would have been preferable. A bulk supply would probably be obtained later from the Southern Railway Co. The consumers would be given the option of flat rates or a two-part charge.

In further evidence it was stated that the Gas Co. had not asked to be heard when they made objection to the Electricity Co.'s Order, and the Electricity Commissioners therefore had no alternative scheme before them.

Finally, as reported, the Committee decided to allow the Bill to proceed on the undertaking that the Gas Co. would give a supply of electricity within twelve months in the "compulsory" area.

**Wireless Telegraphy Bill.** — On March 26th, the Prime Minister informed Mr. Alexander that he was not in a position to name a date for the second reading of this Bill.

**Receiving Licence Fees.**—On March 26th, Lord Wolmer informed Mr. Alexander that the total receipts during the year ended December 31st, 1924, on acount of radio receiving licences were £613,309, of which £472,102 was payable to the British Broadcasting Co. by monthly instalments in arrear.

**Electricity and Unemployment.**—On March 26th, during the debate on the third reading of the Consolidated Fund Bill, the question of the effect of the development of electricity on unemployment was discussed. Mr. Snowden, the late Chancellor of the Exchequer, asked what the Government was doing about the electrical schemes which the Labour Government had left in an advanced stage.

Sir Arthur Steel-Maitland, the Minister of Labour, in reply, said that although the shipbuilding and the iron and steel industries were depressed, with regard to unemployment the electrical and other industries were holding their own. Mr. Snowden's electricity scheme, however, was not quite so far advanced as he had imagined. Such a scheme, involving an immense number of local authorities and involving all the complicated questions of frequency, was of such a type that a scheme of a tenth of that magnitude, in the hands of the most efficient of ordinary concerns, would take a year or two actually to get under way. Here the scheme was to be applied to the whole country, and it was being pressed forward as rapidly as could be.

Mr. Lloyd George asked if the Government proposed to take steps to restore the compulsory powers of the Electricity Commissioners.

Sir A. Steel-Maitland said it was not within his scope to give an answer to that.

Mr. Lloyd George replied that the scheme was no good otherwise.

**The Telephone Service.**—On March 24th, Sir Wm. Mitchell-Thomson informed Mr. Albery that the number of telephones per 1,000 inhabitants at January 1st, 1924, was 142 in the United States and 26 in Great Britain and Northern Ireland. Eleven countries had in use more telephones per 1,000 inhabitants than this country.

**Tramway and Omnibus Competition.**—On March 24th, Mr. Waddington asked the Minister of Transport whether he was aware that in several industrial areas there was great confusion caused by competition between various omnibus services and tramways; that there were other similar areas where the services were not adequate for the public convenience; and if he would consider the setting up of licensing authorities to cover wide areas similar to the Joint Electricity Authorities, representative of both local authorities and private undertakings, with a view to the co-ordination of omnibus and tramway services throughout the country.

Colonel Ashley said he had had under consideration certain alterations in the law with regard to the licensing of public service vehicles in the contemplated Road Vehicles Bill.

**Broadcasting Debates.**—On March 25th, Captain Fraser asked the Prime Minister if he would give the House of Commons an opportunity of deciding the desirability of giving permission to the British Broadcasting Company for the broadcasting of the forthcoming speech of the Chancellor of the Exchequer in the introduction of the Budget; and if he would also consider the whole question of permitting certain proceedings of the House to be broadcast.

Mr. Baldwin said that the answer to the first part of the question was in the negative, but he thought that the time had come when the whole question should be considered, and for that purpose he was thinking of setting up a Select Committee of both Houses.

**Interference with Broadcast Programmes.**—On March 25th Sir Wm. Mitchell-Thomson, in reply to Capt. Fraser, said that the question of interference with broadcast programmes had received, and was still receiving, close consideration, and much improvement had been effected as regarded service and commercial transmissions. With regard to interference caused by electromagnetic radiations, he was always willing, when complaint was made, to give advice and to use such influence as he possessed to secure an abatement of the nuisance. He did not think, however, that the time was ripe for such an inquiry as that suggested.

**Coal Prices and Electricity.** — On March 25th, Captain Garro-Jones called attention to the price of coal, and moved: "That this House calls on the Government to prosecute measures for preventing excessive charges for coal." Referring to the industrial side of the question, he said that we were passing from the use of raw coal as a fuel, and yet, while other nations were adjusting their conditions to

meet that phase, we were doing absolutely nothing to meet it. What, for instance, was the Government doing to assist or encourage the new methods of the low and high temperature carbonisation of coal? Until something of that kind was done we should lose headway. Giving figures to illustrate the high price of household coal, the hon. member urged that the time was ripe for Government action.

Mr. MARCH, a Labour member, pointed out that frequently poor persons, who bought only small quantities of coal, had to pay an average of 56s. to 60s. per ton. In Poplar they were trying to alter that. They were dispensing with coal stoves and installing electricity. Poplar had the finest electricity undertaking in London, and they were supplying electricity cheaper than anyone else in London.

Major ATTLEE, another Labour member, said that the price of municipal electricity over the whole London area, taking the boroughs all together, was one-third cheaper than the price charged by the companies.

Mr. WRAGG, a Unionist member, said he did not necessarily accept those figures. He was not prepared to challenge the figures given as to the price of electricity in Poplar, but it was not fair to take prices of electricity without taking all the relative factors into consideration.

Mr. HERBERT WILLIAMS said that those who had had any experience of electrical engineering knew that there was nothing more difficult than to effect an exact comparison between electrical prices.

Colonel LANE-FOX, the Secretary for Mines, replying, said that the Government was extremely anxious to keep down coal prices, and if it had any reason to suspect profiteering it would not shrink from taking strong action. But full inquiry must be made before any such action was taken, and, if necessary, the Government would ask for powers to deal with the matter.

The motion was rejected by 211 votes to 118.

**The South Wales Electrical Power Distribution Co. Bill.**—A House of Lords Committee, presided over by the Marquis of Bath, last week considered a short Bill promoted by the South Wales Electrical Power Distribution Co., for the object of removing the absolute veto now possessed by county councils in its area upon the erection of overhead mains crossing or running along county roads. The company asked that county councils should come within the meaning of Section 21 (Overhead Wires) of the Electricity (Supply) Act, 1919. Under this Section, the Electricity Commissioners would be the sanctioning authority for the erection of any overhead wires, but before giving a decision the road authority concerned would be heard. At present this does not apply to county councils in the company's area under a clause in the Company's Act of 1900. The County Council of Glamorgan petitioned against the Bill and denied the statement made in the preamble of the Bill that the powers now held by county councils—at any rate in the case of Glamorgan—constituted a restriction of the company's activities.

Mr. W. A. CHAMEN, the general manager of the company, said that the Glamorgan County Council had refused consent in certain cases which had held up important developments in connection with the Barry Docks. The power given to the county councils was being exercised to the disadvantage of the company and against the development of electricity in South Wales.

MR. J. W. JEEVES, K.C., for the County Council, claimed that the absolute veto was agreed upon by virtue of the special circumstances of South Wales and contended that the sanctity of contract was involved in the promotion of this Bill. He also complained that the company had not approached the County Council in this matter in order to ascertain whether an agreement could be arrived at.

The Ministry of Transport offered no objection to the proposal, and the Committee declared the preamble proved.

# Legal.

### Weber v. Birkett.

IN the King's Bench Division, on March 24th, Sir H. Maddocks, K.C., for the defendant, told the Lord Chief Justice that he was in a difficulty and wanted to put himself right for the Court of Appeal. He wanted something to appeal from, and at present he had no order, as his Lordship had found that it was not possible for him, as matters stood, to give a judgment in the case. There were entertaining passages between his Lordship and counsel, but the latter derived little satisfaction, his Lordship leaving him "to his own resources."

### Lapish v. Braithwaite.

A PETITION has been lodged in the House of Lords by the original plaintiff in this case against the reversal of the decision given in a Court of first instance in his favour by the Court of Appeal.

It will be remembered that the plaintiff proceeded against Mr. Braithwaite for penalties alleging that companies of which the defendant was managing director had been given contracts by the Leeds City Council while defendant was a member of that body.

### Palmer v. Shropshire, &c., Electric Power Co.

AT the Birmingham Assizes last week, before Mr. Justice Salter, Elsie Rutherford Palmer, electrical engineer, Birmingham, brought an action against the Shropshire, Worcestershire, and Staffordshire Electric Power Co. for £362, for goods sold and delivered. The case of the plaintiff was that on May 5th, 1924, an oral agreement was made between her agents and two representatives of the defendants, that plaintiff should manufacture for them an electrical sign in accordance with a drawing. In July the sign was delivered and accepted, and the plaintiff invoiced the sign to the defendants at a sum of £362. Mr. R. R. Palmer, who made the sketch for the sign, said it was to be used to show the value of electric advertising. The Judge said that the sign was interesting, clever, and novel. He was satisfied that a commission was given to the plaintiff's husband to make the design, but there was no undertaking to sell the patent rights to the defendants. He gave judgment for £185.

### Priest v. Muntz.

AT Birmingham Assizes on March 25th, before Mr. Justice Salter, a claim for £196 for work done and materials supplied was brought by Thomas Randolph Priest, electrical engineer, Blackheath, against William Edgar Muntz, of Knowle. The plaintiff's claim was in connection with an electrical installation at the defendant's hotel, between July, 1923, and May, 1924. It was mentioned that the defendant had invented a new form of windmill and, in connection with the installation, he required a dynamo which was to be driven by this windmill. The particulars of the claim showed that the total of the account was £322, of which £125 had been received on account. Two defences were raised, the first being that defendant had no liability towards the plaintiff, as his contract for the work was with Messrs. C. J. Groves, contractors, of Dorridge, who were carrying out alterations at the hotel at the time, and that plaintiff was engaged by them to do the work. The second defence was that the work was badly done, and there was a counter-claim. After hearing evidence on the question as to whether or no there was a contract, his Lordship decided in favour of the plaintiff, and referred the action to the Official Referee, in whose discretion he left the question of costs.

# Transformer Short-Circuit Tests.

### A Ferranti 1,200-kVA Transformer.

IN order to determine the effects of short circuits on the electrical and mechanical structure of a transformer, Messrs. Ferranti, Ltd., recently carried out four tests on a 1,200-kVA transformer of the standard core type, 3-phase, 40 cycles, 5,500/440 volts, connected in delta star, with tappings from the centres of the h.p. windings for 3 and 6 per cent. of the normal voltage connected to a Ferranti tapping switch.

The power supply was obtained from a 6,000-kW turbo-alternator, star connected and wound for 5,500 volts, the normal voltage between the lines. Fig. 1 shows a diagram of connections; the transformer h.p. winding was connected direct to the generator through an oil circuit breaker, and the l.p. winding of the transformer was short circuited. The h.p. tappings were set for the minimum voltage (that is, 5,170 volts), so that the full tapping range of the windings was cut out. With this tapping setting the transformer would be tested under the most severe conditions as regards short-circuit forces.

The voltage element of the oscillograph was connected between two h.p. lines, and the current element of the oscillograph was connected in the h.p. line of phase A of the transformer; the delta connection of the transformer was there-

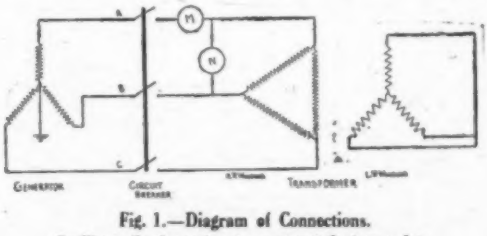


**Fig. 1.—Diagram of Connections.**
Oscillograph elements were connected at M and N.

fore unbroken (M and N, fig. 1). The generator was excited at a definite voltage, and the circuit breaker closed, thus short circuiting the transformer until the overload release tripped the breaker.

*Test No.* 1 was a preliminary one, for which the generator was excited for 3,300 volts. The oscillograph curve showed that the voltage across the transformer dropped to approximately 2,400 volts, and the line current was approximately 1,000 amps. r.m.s.

For *test No.* 2 the generator was excited so that the pressure across the transformer dropped to 3,000 volts.

For *test No.* 3, in order to maintain full line pressure across

the transformer terminals at the instant of short circuit, the generator line pressure was increased. On this test the oscillograph curve showed that for phase A the switch closed at the maximum point in the voltage wave; the short-circuit current was therefore symmetrical. The current values were as shown in Table I, the figures having been taken from the oscillograph curves. The crest value of the current is given, as it is this figure which determines the maximum stresses.

Table I.

| No. of Wave. | Current Crest Value in Amperes. 1st Half-Wave. | 2nd Half-Wave. |
|---|---|---|
| 1 | 1,920 | 1,730 |
| 2 | 1,730 | 1,730 |
| 3 | 1,700 | 1,700 |
| 4 | 1,600 | 1,600 |
| 5 | 1,540 | 1,540 |

*Test No.* 4 was a repetition of test No. 3, in an endeavour to obtain an unsymmetrical short circuit on phase A, in which the oscillograph elements were connected. The oscillograph curve shows that the switch was closed at the zero point in the voltage wave. The current, as shown by the curve, was almost completely unsymmetrical, Table II.

Table II.

| No. of Wave. | Current Crest Value in Amperes. 1st Half-Wave. | 2nd Half-Wave. |
|---|---|---|
| 1 | 3,500 | zero |
| 2 | 3,100 | 400 |
| 3 | 2,650 | 750 |
| 4 | 2,300 | 1,000 |
| 5 | 2,000 | 1,100 |
| 6 | 1,800 | 1,200 |
| 7 | 1,500 | 1,300 |
| 8 | 1,350 | 1,300 |

The oscillograph curves for this test are reproduced in fig. 2, the thick unmarked curve in this figure representing the normal full-load current to the same scale as the short-circuit current to show their relative values. Since the switch cannot be closed at the maximum point in the voltage wave on all

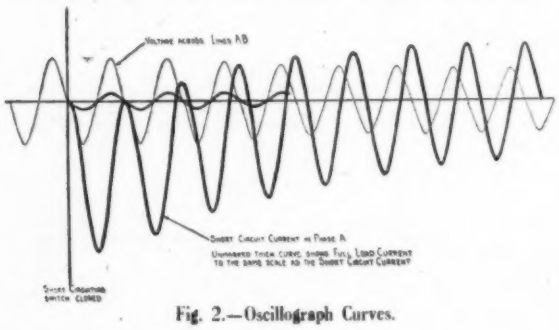
Voltage across Lines A B
Short Circuit Current in Phase A
Unmarked thick curve shows full Load Current to the same scale as the Short Circuit Current
Short Circuited Switch closed

**Fig. 2.—Oscillograph Curves.**

three phases, the short-circuit current must be unsymmetrical for one or two of the phases for all tests. For phase A of the transformer the unsymmetrical short circuit occurred in No. 4 test, and the oscillograph curve showed that the short-circuit current was approximately 100 per cent. displaced. Since there is no time lag effect in mechanical stresses, this represents the severest short-circuit conditions.

For this test the maximum instantaneous value of the current occurred during the first half of the first wave when the value was 3,500 amps. The normal full-load crest value of the current at 5,170 volts is 190 amperes, so that the actual short-circuit current reached 18.4 times the normal full-load value. As the mechanical forces in a transformer are proportional to the square of the current, the mechanical stresses on the windings and coil supports would, therefore, be 338 times the normal values.

The transformer showed no signs of stress during the test, and there was nothing to indicate that the conditions were abnormal. Immediately after the tests the transformer was energised at normal voltage, and showed no signs of unusual behaviour. Eight days later the transformer was removed from its tank and thoroughly examined. No signs of any mechanical strain, or movement of the windings, or disturbance of the structural work could be detected.

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**City of Leicester, Traffic Lighting.**—We are informed by Mr. W. J. Liberty, the hon. secretary of the Institution of Public Lighting Engineers, that in order to assist in the traffic control of one of the main roads in Leicester, the Superintendent of Public Lighting, Mr. Thomas Wilkie, acting on the instructions of the Lighting Committee, is erecting a spot-lighting apparatus. The light will be projected from a pole 30 ft. high, and the beam focused on the pointsman on duty. It is hoped by this means to make the pointsman's signals clear to drivers of vehicles and also to pedestrians. The experiment is being closely watched in Leicester, as this installation will be the first of its kind in Britain.

# Reviews.

**Sub-Station Operation.** By Edwin Kurtz, M.S. Pp. 261+ xii; figs. 210. London: McGraw-Hill Book Company, Inc. Price 12s. 6d. net.

This book has been drawn up for the benefit of sub-station operating engineers, and gives an outline of the underlying principles as well as the practical aspects of the subject.

The treatment of elementary electrical principles is done in a way which should be readily understandable to anyone, the well-known method of illustration by means of hydraulic analogies being followed. In this section all the ordinary types of electrical machinery and apparatus are mentioned for illustration. Thereafter sub-station apparatus is dealt with in somewhat greater detail, the types of machines described being transformers, frequency changers, the a.c. generator, the motor generator, and the rotary converter.

A long section is then devoted to wiring diagrams and descriptions of detail apparatus used in converting sub-stations.

The remainder of the book deals with the actual operation of various classes of machines, the troubles which may be met with, inspection, maintenance, logging of results, safety, and test questions for sub-station operators. The test questions are of a particularly exhaustive and common-sense nature, but anyone who could answer them all would not long remain a sub-station engineer.

The reviewer's experience of sub-station engineering in Britain has shown him that the usual method of procedure in training a sub-station engineer is to leave any new-comer in the hands of an experienced man and allow him to pick up as much as possible by direct observation. He has never known of any case in which engineers were systematically examined.

The present volume is based wholly on American practice, but it is well worth perusal by any sub-station engineer, and the material contained in it might well serve as a starting point for the production of a similar book more suitable to British needs.

The printing and reproduction of the diagrams are well up to the usual high standard of the McGraw-Hill Company.

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**The Platinum Metals.** By E. A. Smith. Pp. 123+xii; figs. 35. London: Sir Isaac Pitman & Sons, Ltd. Price 3s. net.

The extensive uses to which platinum is nowadays put, is probably realised by few. The author brings to light in a general survey of the production, treatment and uses of this metal, its great values in the industrial world.

The volume deals with the subject in a somewhat historical way, giving it an educational value. The earliest recognition of platinum is traced back to 1735, and although the development of the platinum industry did not begin in earnest until 1876, the author describes the treatments to which it has been subjected and the discoveries made in its connection from the early date; while the sources of supply and the methods of obtaining crude platinum, particularly that of dredging, are dealt with in an interesting manner.

Platinum has probably found as many uses in the electrical industry as in any other, and in chapters on the uses of platinum these specific uses are dealt with fully, particularly those of the electric tube furnace, electric contacts and the X-ray; and those properties of the metal by virtue of which it lends itself to the electrical industry are given apart from its many physical and chemical properties of use in other important industries.

Credit is due to the author for the interesting manner in which the work is written.

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**A Dictionary of Electrical Terms.** By S. R. Roget, M.A., A.M.I.E.E. Pp. vii + 296. London: Sir I. Pitman and Sons, Ltd. Price 7s. 6d.

An Electrical Dictionary has been wanted for quite a long long time—something between the encyclopædic handbook which occupies half a dozen corpulent volumes and the "List of Electrical Terms" often appended to the semi-popular type of electrical book to ensure that the reader is not entirely befogged in an uncharted sea of technicalities.

Mr. Roget's dictionary can be whole-heartedly commended for its successful endeavour to steer a middle course between incompleteness and redundancy. It has obviously needed a unique capacity for decision in settling what was to be included and what left out. Some of the difficulties under this and other heads are mentioned by the author in his preface, but after testing the book on many electrical subjects we have come to the conclusion that few matters of importance to the electrical engineer have been omitted and that the information given is entirely adequate and reliable.

The range covered embraces electric light, power and traction; telegraphy and telephony (including wireless) and the general science of electricity and magnetism. There would appear to be about 5,000 alphabetical headings comprised within 300 pages. As the author very rightly remarks, there is in technical literature too much looseness and diversity of expression, and we are convinced that in compiling this dictionary Mr. Roget has made a very effective contribution towards that rectitude of electrical thought and expression which is so essential to the true development of electrical science.

P.H.S.K.

# Business Notes.

**Bankruptcy Proceedings.**—W. G. HEAD, electrical engineer, Ashford, Kent.—The public examination of this debtor was held recently at the Guildhall, Canterbury. The statement of affairs showed liabilities of £1,192, against assets of £104, or a deficiency of £1,088. Debtor stated that when he commenced business he borrowed £250 from a bank, and his account was eventually overdrawn to the extent of nearly £470. His brother-in-law was guarantor to the bank for £200. Debtor agreed that he had been in business for about a year and nine months, and he had been losing at the rate of £624 a year. Most of his work consisted of small installations of electric lighting and bells. He admitted that his profits were insufficient to meet his working expenses. The examination was closed.

A. H. MONCRIEFF, wireless manufacturer, late of 60, Thornton Road, Bradford.—Receiving order made March 24th on debtor's own petition.

J. ISHERWOOD, wireless and photographic dealer, 91, Lee Lane, Horwich.—First meeting, April 7th, at the Official Receiver's offices, Byrom Street, Manchester; public examination, April 21st, at the Court House, Bolton.

A. VIVIAN, electrical engineer, 180, Gray's Inn Road, W.C.—Trustee, Mr. D. Williams, Official Receiver, Carey Street, W.C., released March 20th.

M. C. JONES (M. C. Jones & Co.), stockists of wireless parts and accessories, 239, Westgate Road, and 65, Thornton Street, Newcastle-on-Tyne.—Last day for proofs for dividend, April 10th. Trustee, Mr. W. Brittain, Pearl Buildings, Newcastle-on-Tyne.

R. HAMMOND, electrical engineer, 3, The Arcade, George Street, Richmond, Surrey.—Last day for proofs for dividend, April 7th. Trustee, Mr. E. H. Hawkins, 4, Charterhouse Square, E.C.1.

C. PEACOCK, electrical engineer, 51, Gillygate, York.—First and final dividend of 3s. 11d. in the £, payable April 6th, at the Official Receiver's office, Duncombe Place, York.

**Company Liquidations.**—FALLON CONDENSER MANUFACTURING CO., LTD., Broad Lane, Tottenham.—The creditors of this company were called together recently at the Holborn Town Hall. The chair was occupied by Mr. S. Allen, of 174, Northumberland Park, N., who had been appointed to act as the liquidator in the voluntary liquidation of the company. It was stated that the assets totalled £4,113, and that there was a surplus, so far as the creditors were concerned, of £652. The claims of the trade creditors totalled £2,868, whilst £47 was due in respect of rent and there was a small amount outstanding for repairs of about £8 An amount of £288 was also allowed in respect of future rent of the premises and £250 for income tax. The liquidator said that if a satisfactory realisation took place the position as regarded the creditors would be a fairly satisfactory one. The stock consisted largely of condensers, which had been bought in parts and assembled by the company. The company had spent, during 1923 and 1924, a sum of £1,800 on advertising, and the Inspector of Taxes would only allow 50 per cent. of the amount.

The CHAIRMAN stated that the company was formed in March, 1923, and during the first year's trading there was a profit of £87. The figures for the trading since March of last year had not been prepared, but possibly a loss had been incurred.

Mr. P. HOUSTOUN said that the principal asset was the stock and he would like to have known what the cost price was.

Mr. M. J. FALLON said that the stock included component parts purchased for the manufacture of the company's specialities, which cost £2,051. The made-up stock had been valued at the selling prices, and it totalled £1,096.

Mr. HOUSTOUN: How was the stock valued when the last balance sheet was prepared?

Mr. FALLON: At cost.

Mr. P. WELLS, of the Wholesale Traders' Association, said that the stock seemed very large in comparison with the book debts, and asked whether a cash business had been carried on. The Chairman replied that the business had been chiefly a credit one; monthly accounts had been allowed, but many factors and dealers took considerably more.

Mr. HOUSTOUN asked if the company had any substantial contracts running for the supply of component parts. He added that if there were such contracts there might be contingent claims to be considered. The Chairman replied that there was one such claim for £658, in respect of five contracts which had been entered into by the company. The creditor was claiming £658 as representing loss of profits. That claim had not been included in the liabilities, and it was possible that other claims would be received.

After some discussion a resolution was passed in favour of an application being made to the Court for the appointment of Mr. R. H. Dutchman, C.A., of Moorgate Station Chambers, E.C., as the liquidator of the company, while a committee was also nominated, consisting of the representatives of the Crystalate Manufacturing Co., Messrs. Bissell & Co., McLeod and McLeod, Barclay's Advertising Co., and W. G. Stewart.

The solicitor to the company stated that in order to obviate the expense of such an application the present liquidator would resign. A further meeting of shareholders would then be called and the creditors' nominee would be appointed as the liquidator.

The following are creditors:—

| | £ | | £ |
|---|---|---|---|
| Crystalate Mfg. Co. ... ... | 465 | Hughes & Co. ... ... ... | 93 |
| Bissell & Co. ... ... ... | 405 | Stevenson & Co. ... ... ... | 85 |
| McLeod & McLeod ... ... | 329 | Burham & Sons ... ... ... | 73 |
| Barclay's Advertising Co. ... | 440 | National Cash Register, Ltd. ... | 71 |
| Muller & Co. ... ... | 165 | Newnall & Co. ... ... ... | 46 |
| Solidite, Ltd. ... ... | 130 | Collett & Son ... ... ... | 33 |
| Birkbys & Co. ... ... | 125 | North Metropolitan Electric Power Supply Co. ... ... | 96 |
| Francis Mfg. Co. ... ... | 117 | International Time Recorders, Ltd. ... ... ... ... | 24 |
| Gilson, D., & Co., Ltd. | 108 | | |

STANDARD ACCESSORIES CO., LTD., radio dealers, 56, High Street, Bloomsbury, W.C.—The creditors of this company were called together on March 25th, at the offices of Messrs. H. Rainsbury & Co., I.A. Mr. H. Rainsbury submitted a statement of affairs which disclosed liabilities of £2,316, of which £1,798 was due to the trade and £518 to Mr. H. A. Kaplan, one of the directors. The assets were valued at £294, leaving a deficiency as regarded the creditors of £2,022. Mr. Rainsbury stated that since the statement of affairs had been compiled he had received and had accepted an offer for the stock of £178, and had sold the furniture for £35. He had to discharge an execution creditor's claim of £49, and consequently there would be a sum of £168 to meet the claims of the creditors. The chairman further stated that the company was registered on October 4th last, with a nominal capital of £500. He had prepared figures of the trading, and it appeared that the purchases that totalled £6,605, against sales of £5,437, and there had been a gross loss of £605. Mr. SUNDERLAND said he could not understand how the gross loss had arisen. He pointed out that a private meeting of the creditors had previously been held, when the liabilities were stated at £1,950, and no mention was then made of Mr. Kaplan being a creditor. Mr. RAINSBURY said he understood that Mr. Kaplan would withdraw his claim. Mr. SUNDERLAND said the figures presented showed that stock had been sold at something like 10 per cent. less than the cost prices. His view was that the company should be wound up compulsorily and the trading of the company investigated by the Official Receiver. Eventually the meeting broke up without any resolution being passed. Mr. SUNDERLAND stated that he was given to understand that one creditor would file a petition for the compulsory liquidation of the company, and the other creditors could support him. The following are creditors:—

| | £ | | £ |
|---|---|---|---|
| Fuller's United Electric Works Ltd. ... ... ... ... | 68 | Behr, N. ... ... ... ... | 46 |
| Fellows Magneto Co., Ltd. ... | 321 | Power Equipment Co. ... ... | 45 |
| Ormond Engineering Co. ... | 190 | Behm, A. ... ... ... ... | 37 |
| Arnold Thomas ... ... ... | 150 | Millett, J. ... ... ... ... | 37 |
| Aku Co. ... ... ... ... | 147 | Vandervell, C. A., & Co., Ltd. | 35 |
| Sel-Ezi Wireless Supply Co. | 76 | Ripaults, Ltd ... ... ... | 33 |
| Ego Engineering Co. ... ... | 68 | Arthumo Wireless Stores ... ... | 32 |
| Buzl, G. ... ... ... ... | 61 | Melbourne Radio Supply ... | 25 |
| Zeltlin & Son ... ... ... | 54 | Bedford Electric & Radio Co., Ltd. ... ... ... | 22 |
| Energo Products ... ... ... | 50 | *Wireless Trader* ... ... ... | 22 |
| Stewart, J. H. ... ... ... | 48 | Dawsons ... ... ... ... | 20 |

MECHANICAL ADS., LTD., Sentinel House, Southampton Row, London, W.C.—A compulsory winding up order having been made against this company, which carried on business in electrical advertising devices, the first meetings of the creditors and shareholders were held on March 25th at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C. Mr. E. T. A. Phillips, Official Receiver, reported that the company was incorporated on October 6th, 1922, with a nominal capital of £2,000, to carry on business as advertising contractors and agents, suppliers of advertising apparatus, &c. For the purpose of its business the company purchased and installed at various railway stations in London a number of advertising machines. A considerable number of these machines were also installed at the British Empire Exhibition at Wembley. The failure of the company was attributed to commencing operations with too little capital; to the fact that the business at the British Empire Exhibition did not prove sufficiently lucrative; to the heavy cost of putting the advertising machines on the market, and other causes. The liquidation was left in the hands of the Official Receiver.

NORWOOD WHOLESALE FITTINGS SUPPLY CO., LTD., Walworth Road, S.E.—At the offices of the Board of Trade, Carey Street, on March 27th, the statutory meetings of the creditors and shareholders were held under a compulsory winding up order, made against this company. The company was registered in May, 1924, with a nominal capital of £1,000, to act as dealers and agents in radio sets, parts, gramophones, electrical fittings, and goods and accessories of every description. The first directors were Jack Bolsom and Charles Slater, but they resigned on December 1st, 1924, in favour of A. A. J. Allen and Mrs. Annie Bagel. Bolsom acted as managing director, and he states that he purchased a radio business carried on at 71, High Street, South Norwood, for £300, for which he gave acceptances which were still outstanding, although the shop and assets were handed over to him. He re-sold the business and assets to the company at the same price (£300), payable in shares. In September, 1924, a branch known as the Elephant Electric Emporium was opened at 56a, Walworth Road, S.E.,

and subsequently the whole of the Norwood business was transferred there. The trading, however, proved unsuccessful, a loss of £1,506 being shown in the accounts for the period to November 8th, 1924. On December 5th, Mr. A. J. P. Coleman was appointed receiver by the debenture holder, and on December 11th an extraordinary resolution was passed for voluntary liquidation, and Mr. Coleman was also appointed liquidator. In consequence thereof, Mr. Chas. Austin was, on the same date, appointed receiver for the debenture holder in place of Mr. Coleman, and he had since been in possession of the assets. The failure of the company was attributed to heavy expenses and to the fact that part of the goods purchased turned out to be unsatisfactory. A statement of the company's affairs showed, as regarded creditors, ranking liabilities of £2,986, and net assets (after deducting loans on debentures) of £1,259. As regarded shareholders, the paid-up capital was £400, and the total deficiency amounted to £2,127. The liquidation was left in the hands of the Official Receiver.

Wireless Service, Ltd.—Winding up voluntarily. Liquidator, Mr. W. R. Theobald. Meeting of creditors, April 7th, at the offices of Messrs. Clinch & Legge, 119, Moorgate, E.C. Particulars of claims forthwith to Mr. W. R. Theobald, 119, Moorgate, E.C.

Anode Wireless & Scientific Instruments, Ltd.—First and final dividend of 1s. 10½d. in the £, payable at Carey Street, W.C.

**Private Arrangements.**—Mrs. Jean Baker, trading as the Cinema & Radio Trading Co., 88, Renfrew Street, Glasgow.—The creditors interested herein were called together recently, when a statement of affairs was submitted which showed liabilities of £802, all due to the trade. The assets were valued at £475, a deficiency of £328. It was reported that the business was established in November, 1923, with a capital of about £50. The books had not been sufficiently well kept to allow of trading figures being prepared, but it was believed that the deficiency was entirely due to the loss sustained through the taking up of radio goods. A resolution was passed in favour of the matter being dealt with under a trust deed to Mr. W. B. O. M'Dougall, C.A., of 175, West George Street, Glasgow, with a committee of three of the principal creditors. The creditors include :—

| | £ | | £ |
|---|---|---|---|
| General Electric Co., Ltd. ... | 97 | Bordesley Accessories Co., Ltd. | 22 |
| Mackay & Ore ... ... ... | 45 | Northern Steel & Hardware Co. | 27 |
| Falk, Stadelmann & Co., Ltd. ... | 57 | Sloan Electric Co. ... ... | 31 |
| Glasgow Numerical Co. ... | 108 | Reid, J. H ... ... ... ... | 35 |

**Dissolution of Partnership.** — L. J. Palmer & Co., electrical engineers and contractors, 141, Newspaper House, Corporation Street, Birmingham.—Mr. L. J. Palmer and Mr. C. W. Rhodes have dissolved partnership.

**Trade Announcements.**—Mr. M. Porn, sole concessionaire for the United Kingdom and Ireland for Stigler-Lifts, Milan, Italy, has removed from 21, Mincing Lane, E.C., to 72-78, Fleet Street, E.C.

Mr. R. C. Toogood, formerly partner in Crow, Toogood and Co., of London, &c., has commenced business on his own account as the Essex Wholesale Electrical Co., at 709, Romford Road, Manor Park, Broadway, London, E.12, where he wishes to receive manufacturers' price lists.

Mr. F. J. North, radio engineer, has opened premises at 22, Oxford Road, High Wycombe.

A radio department is being opened in High Street, Ashford, Kent, by Charles Hayward & Son, electrical engineers.

Messrs. Gordon & Moodycliffe, electricians, of 165, King Street, Castle-Douglas, have opened new premises at 95, Irish Street, Dumfries.

Messrs. Fuller's United Electric Works, Ltd., have removed their Manchester depôt to larger premises at 19, Chapel Walks, Cross Street. 'Phone : " City 857."

The address of the Costa Rica Electric Light & Traction Co., Ltd., is now Broad Street House, 62, Old Broad Street, London, E.C.2.

Among the new companies registered in Scotland last week was :—The Cable Lamp Co., Ltd., 40A, North Street, Dundee (private company), engineers. Capital, £2,000, in £1 shares.

**Lead.**—Reporting on March 28th, Messrs. James Forster and Co. state :—" Conditions are unchanged; the demand from consumers is still slack, particularly from cable-makers, and with the prospect of full supplies, prices had to give way. Unless there is a fundamental change in the present position of supply and demand, there seems nothing to prevent prices falling lower still."

**Catalogues and Lists.**—Messrs. W. T. Henley's Telegraph Works Co., Ltd., 11, Holborn Viaduct, E.C.1.—List UM 1, containing full particulars of the company's joint-box compounds and accessories (buckets, portable furnaces, connectors, &c.).

The Sun Electrical Co., Ltd., 118-120, Charing Cross Road, W.C.2.—An illustrated booklet dealing with the " Sanco " connector box and other wiring materials and accessories, and a catalogue of " daylight " lighting fittings. Priced.

Messrs. Higgs Bros., Witton, Birmingham.—A price list of a.c. and d.c. motors and generators.

Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester.—A series of illustrated leaflets dealing with the company's control switchboards, stone switch cubicles, control and instrument wiring, out door sub-station equipments, &c.

The Stonebridge Electrical Co., Ltd., Victoria Road, North Acton, W.3.—Two illustrated pamphlets dealing respectively with synchronoscopes and power-factor meters for switchboard installations.

Ateliers de Constructions Electriques de Charleroi, 36, Victoria Street, S.W.1.—A catalogue of d.c. motors and dynamos.

The Essex Wholesale Electrical Co., 709, Romford Road, Manor Park Broadway, E.12.—Net trade price lists of electrical and radio accessories.

The Electric Depot, Ltd., Pritchett Street, Aston, Birmingham.—An illustrated and priced pamphlet dealing with accumulator charging boards.

Siemens and English Electric Lamp Co., Ltd., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 76, containing illustrations and full details of shop-window lighting equipment supplied by the company, including signs and time switches. Also Leaflet No. 77, illustrating and describing spot-light projectors for shop windows.

The British Thomson-Houston Co., Ltd., Newman Street, Oxford Street, W.1.—A mailing card advertising " X-Ray " shop-window reflectors.

Brookhirst Switchgear, Ltd., Northgate Works, Chester.—Calendar sheets for April, May and June, depicting parts of the city of Chester.

Metro-Vick Supplies, Ltd., 4, Central Buildings, Westminster, S.W.1.—A " Cosmos " radio catalogue and handbook dealing with all kinds of radio apparatus and accessories. Also a selection of examples of newspaper advertising.

**Engineering Employés' Wages.**—Delegates of the trade unions involved in the application for a general increase of 20s. per week in the wages of engineering employés met in London on March 26th to receive reports from the various executives on the position created by the employers' refusal to concede the demand. At the outset a letter from the Minister of Labour was read. This asked the delegates to appoint a small committee to confer with him on the matter with a view to the reopening of negotiations between the two parties. The suggested committee was appointed, and after interviewing the Minister it reported that the formation of a joint committee of employers and employés had been mooted by the Minister. After some discussion the delegates elected eight members to serve on such a committee, Mr. J. T. Brownlie, the chairman of the A.E.U., being one of them. The employers, who had also been approached by the Minister, took similar action, and the committee thus constituted was to meet during the current week.

The Manchester *Daily Dispatch* reports that over 1,000 members of the A.E.U., the E.T.U., the Boiler-Makers' Society, and other unions in the Manchester district have demanded an increase in wages from 1s. 2½d. to 1s. 7d. an hour. They threatened that if their demand was not conceded within seven days a strike would occur.

**For Sale.**—The City and South London Railway Co. invites offers for surplus plant and machinery recently used in connection with the enlargement of tunnels, including electrical runway, motors, cranes, &c. Keighley Corporation Electricity Department has for disposal two motor-generator sets, 150 kW and 400 kW. Mansfield Corporation Electricity Department invites offers for surplus electric generating plant. Salford Corporation Electricity Department has for disposal surplus plant, including turbine feed pumps, &c. (See our advertisement pages to-day.)

**Chinese Notes.**—The Tunghsien (Peking) Chamber of Commerce is organising a company with a capital of $1,200,000 to supply electricity for the city. Machinery has arrived from abroad, and the company hoped to commence operations in March.

The Peking Tramcar Co. opened a third route in January following closely upon the commencement of the first two routes. It is reported that business is good and the company's cars are crowded to capacity.

**Local Exhibitions.**—Grimsby.—An electrical exhibition, under the auspices of the Corporation Electricity Committee, was opened at the Grimsby Town Hall on March 24th, by the Mayor (Ald. F. Barrett). The principal attraction is a model house in the various rooms of which the many applications of electricity are demonstrated. In addition to this there is a special shop-window lighting display arranged for tradesmen, and a radio section containing all kinds of apparatus.

Liverpool.—Arrangements are in hand for the holding of an Ideal Homes, Health, Housing, and Wireless Exhibition at the Philharmonic Hall from April 18th to May 2nd. The organisers are the National Exhibition Association, 23, Great James Street, Holborn, W.C.2.

Edinburgh.—The Royal Sanitary Institute is to hold a Health Exhibition in the Waverley Market in July in connection with the congress of the Irstitute. There will be housing and sanitation exhibits and a display of labour-saving gas and electric cooking and lighting appliances.

**Neuhausen Aluminium.**—The report of the Aluminium Industrie, A.G. of Neuhausen, whose financial results for 1924 have been previously recorded (15 per cent. as against 12 per cent. in 1923), states that the works were fully occupied during the whole of the year and it was possible to increase the production, and also obtain better prices than in 1923. Concerning the holdings in other concerns the report states that an augmentation in the output took place in the case of the French companies, and the claims made by the French undertakings for compensation were being continued under legal process. The chemical works in Germany suffered from the coal strike and the stabilisation crisis, although the conditions have now improved and the works are operating in a normal manner. The works in Switzerland which manufacture aluminium products were well employed.

**Unemployment.**—The total number of unemployed as at March 16th was 1,219,200, a reduction of 1,533 during the week, but 125,000 more than a year ago.

**Swedish Lock-out Ended.**—The labour dispute in the electrical fittings trade was definitely settled on March 26th, both parties having accepted the arbitration proposal. Work was to be resumed on March 30th. A settlement was also reached in all the remaining labour disputes, the parties having accepted the new mediation proposals submitted to them.—*Reuter's Trade Service* (Stockholm).

**French Export Trade.**—M. Jean Rey, president of the Syndicat Professionnel des Industries Electriques, stated at the annual meeting, held in Paris on March 17th, that many foreign countries were still unaware that France was able to meet their electrical requirements. It was therefore necessary to make methodical efforts to place before them the information and commercial facilities without which it would be vain for French makers to hope to create a place for themselves in these markets. It was with the same directive ideas that the French economic mission to Japan, in which some of the French firms had participated, had been conceived, and a similar observation applied to the contemplated Norwegian mission to France. During last year a mission of engineers from Czecho-Slovakia had visited several of the principal French works and expressed their surprise, as previously they were unaware of the existence of the industry. But according to the impressions gathered by M. M.M. Koch (one of the members of the syndicat) at the general meeting of the Electro-Technical Association of Czecho-Slovakia, the latter country did not appear to offer openings for French export industry, as it already had an electrical industry that could produce more than could be absorbed by the inland market. On the other hand, the president remarked that the same difficulties should not arise in regard to the Scandinavian countries, particularly Norway, which had great resources in water powers and vast programmes of electrification, which involved a great consumption of electrical machinery which the native works were far from being able to supply. During the past year various occasions had been indicated for the opening of markets in different countries, especially in Bulgaria, Egypt, the Canary Islands, &c. In conclusion, the president stated that exporters required the assurance that the engagements entered into by firms ordering their manufactures should be faithfully observed; experience showed that this matter was important.

**Lamp Manufacture in Belgium.**—The report of the Société la Lampe Belge, dealing with the financial year consisting of the eight months ended with last December, states that the turnover largely increased, although sales slackened during the later months owing to the importation of large quantities of foreign lamps in view of the introduction of new import duties. The accounts show net profits amounting to 137,643 fr., which sum has been devoted to depreciation.

**Social Events.**—The annual dinner of the staff of Messrs. H. W. Sullivan, Ltd., which had been postponed on account of the illness and subsequent death of the founder of the firm (Mr. H. W. Sullivan), was held at Frascati's on March 27th. There was a large gathering, and the opportunity was taken by the chairman (Lt.-Commander W. G. Bishop, O.B.E., R.N. (ret.), to introduce the two new directors, Mr. P. H. Stephens and Mr. D. A. Stevens, B.Sc., A.M.I.C.E. The chairman at the commencement made sympathetic reference to the late Mr. H. W. Sullivan, and the company rose in silence as a tribute to his memory. The toast list included "The Staff and Employés," which was proposed by the chairman, who said that the company was considering the acquisition of larger premises to deal with the enormously increased business which it was receiving. The announcement was welcomed on behalf of the employés by Mr. A. Richardson, who replied to the toast. The health of the chairman and directors was proposed by Mr. H. F. R. Grantham, and briefly replied to by each of the directors in turn. The enjoyment of the evening was increased by musical and humorous items by Miss Vera Siddons and Messrs. Robert Carr, Dion Lane, and Herbert Townshend (accompanist).

The staff and friends of the Siemens companies held a dance at Slater's Restaurant, Oxford Street, W.1, on March 27th. Mr. C. D. Hughes acted as M.C., and the music was provided by the "Southern Blues" orchestra.

**A Swedish Radio Association.**—Several of the most important Stockholm firms interested in the importation, manufacture, and sale of radio products have formed an association known as Svenska Radio Intressentforbundet (the Swedish Radio Association). The members include the Allgemeine Elektricitats-Gesellschaft, Allmanna Svenska Elektriska Aktiebolaget, Radiobolaget, Nordiska Kompaniet, A/B Baltic, A/B Forsner, all of which are manufacturers, and A/B Stern and Stern, as well as a number of other importers and dealers. The object of this association is to protect the interests of the Swedish radio industry and to exchange market information in addition to promoting interest in radio on the part of the public.—*Commerce Reports.*

**Electrical Propaganda Films.**—At the risk of being charged with repetition, we wish to remind electrical men in the London area of the announcement (ELEC. REV., March 20th, p. 452) that they and potential users of electrical films prepared by E.D.A. as part of its educational propaganda activities, will have an opportunity of seeing the eleven films at an exhibition at Australia House, Strand, W.C.2, on Friday, April 17th, at 7.30 p.m. The hall has seating accommodation for 500. Those interested should apply to the Association (15, Savoy Street, Strand, W.C.2) for invitation tickets.

**Electrical Imports into Portugal.** — On March 24th the Portuguese Legislature passed a Bill exempting from Customs duty for five years all imports of material destined for the electrification of the railways and hydro-electric installations in the mining districts.—*Reuter* (Lisbon).

**New French Company.**—La Société pour la Fabrication des Projecteurs Electriques Marchal is the name of a new company which has recently been formed in Paris (134 Avenue Malakoff), with a capital of 800,000 fr., to manufacture electric headlights for motor vehicles.

**German Magneto Firms Amalgamated.**—Consolidation of two of the largest German magneto manufacturers has recently been consummated, according to a report from Stuttgart. They are the Robert Bosch Co. and the Eisemann Werke, both of Stuttgart. The report states that the agreement entered into does not involve any exchange of shares or change in the respective directorates. The number of types of magnetos and other motor accessories now being manufactured by the two firms will be reduced, raw materials will be purchased jointly, and competition in selling will be eliminated.

**British Trade Mark Applications.** — The following are among the recent applications for British trade marks. Objections against any of the marks may be lodged within one month from March 25th :—

Eos. No. 456,449. Class 4.—Eugen Conradty, trading as C. Conradty, 9, Spittlertorgraben, Nuremburg, Germany (S. Sokal, 1, Great James Street, Bedford Row, W.C.1).

Emsco. No. 445,935. Class 8. Instruments and apparatus for use in radio telephony.—A. K. E. Strathdee, trading as the Electrical and Mechanical Supplies Co., 24, Leytonstone Road, E.15.

Atlas. No. 452,198. Class 8. Radio apparatus.—H. Clarke & Co. (Manchester), Ltd., Eastnor Street, Old Trafford, Manchester.

Frihonite.—No. 452,760. All goods in Class 8.—Fritz Hofmann, trading as the Fritz Hofmann Elektrotechnischefabrik, 30, Hofmannstrasse, Erlangen, Germany (Marks & Clerk, 57-58, Lincoln's Inn Fields, W.C.).

Excelsior (lettering and design). No. 456,300. Class 8. Galvanic cells, batteries and accumulators.—Pala Kodes & Co., 15, Sandthorquai, Hamburg, Germany (Cruikshank & Fairweather, 65-66, Chancery Lane, W.C.).

Reprofecta. No. 455,778. Class 8. Instruments and apparatus for use in radio signalling and telegraphic instruments.—Radio Engineering Co., Ltd., 70, Victoria Street, S.W.1.

Carmenta. No. 455,664. All goods in Class 8.—The Electrical Equipment and Carbon Co., Ltd., Bank Buildings, 109-111, New Oxford Street, W.C.1.

Stadiovox. No. 455,999. Class 8. Radio apparatus.—Alfred Barson, 32, Conway Road, Leicester.

Bonnivox. No. 456,013. Class 8. Radio apparatus.—D. Kennedy, 215, Selhurst Road, South Norwood, S.E.25.

Telware. No. 456,130. All goods in Class 8.—The Electrical Equipment and Carbon Co., Ltd., Bank Buildings, 109-111, New Oxford Street, W.C.1.

Lilliput. No. 456,146. Class 8. Radio and telephonic apparatus.—Sterling Telephone and Electric Co., Ltd.

Hablo. No. 453,191. Class 13. Electric switches (ordinary). H. B. Old, 3, St. Jude's Avenue, Nottingham.

Diaduct. No. 453,323. All goods in Class 13. No. 453,232. All goods in Class 18. Terra-Grip. No. 453,233. All goods in Class 13. No. 453,234. All goods in Class 18.—Simplex Conduits, Ltd.

Pontelec. No. 456,030. Class 18. Electric welding plant.—Buckley, Saunders & Co., Ltd., 8, Princes Street, S.W.1.

**Electrical Machinery in China.**—In the course of an article on this subject, *Commerce Reports* says that, beginning with 1921, European, particularly German and Swiss, competition began to show itself to a very appreciable degree, offering equipment which, although in many cases considered inferior to American manufacture, was acceptable to Chinese purchasers, particularly at the prices offered—50 to 75 per cent. of the manufacturers' selling price of American makes. Swiss manufacturers have taken a very large number of contracts, and the equipment they have supplied appears to be first class in every respect. English manufacturers have supplied material which undoubtedly is first class, and the criticism in regard to lower quality and efficiency is directed mostly against German equipment. European manufacturers, their agents and representatives, and particularly Germans, are very anxious to regain this class of business in China. This is evidenced by a large number of representatives now competing for power plant business there.

**Electric Drive at Railway Depôt.**—The G.W.R. Engineering Department's depôt at Reading, which has up to the present been driven by means of a gas engine, is being equipped for electric driving.

**Book Notices.**—Publications of the United States Bureau of Standards. Technologic Paper No. 271, "Measurement of Electrical Resistance and Mechanical Strength of Storage-Battery Separators" (10 cents); Technologic Paper No. 274, "Use of United States Government Specification Paints and Paint Materials" (10 cents); Scientific Paper No. 497, "Thermal Expansion of Aluminium and Various Important Aluminium Alloys" (15 cents); and Miscellaneous Publication No. 59, "Weights and Measures" (report of inter-State conference) (35 cents). Washington: Government Printing Office.

Scientific Papers Nos. 14-18 inclusive, of the Japanese Institute of Physical and Chemical Research. Tokio: Iwanami Shoten.

"Science Abstracts" (A and B). Vol. XXVIII. Part 3. March 25th, 1925. London: E. & F. N. Spon, Ltd. Price 3s. each. net.

"Practical Advice to Inventors and Patentees—Inventions and How to Patent Them," by C. M. Linley. Pp. vi+126; figs. 8. Price 3s. 6d. net. London: Sir Isaac Pitman & Son, Ltd.

"Electric Wiring Diagrams for Motor Vehicles," by M. A. Codd. Pp. 145. London: E. & F. N. Spon, Ltd. Price 3s. 6d. net.

Illustrated Technical Dictionaries in Six Languages. Vol. XV, "Spinning: Its Processes and Products." Pp. 951. London: Lewenz & Wilkinson, Ltd.

"Mon Post de T S F," by J. Roussel. Pp. 192; 156 figs. Paris: Libraire Vuibert. Price 10 fr.

**Accumulator Manufacture in Australia.**—The Clyde Engineering Co., Ltd., of Sydney, has recently taken up the manufacture in Australia of accumulators for motor-car lighting and starting.

**Commercial Travellers' Benevolent Institution.**—The festival dinner held at the Hotel Victoria, Northumberland Avenue, on March 20th was an undoubted success. The appeal remains open until October, and it is hoped that the fine total of £8,215 announced at the dinner will be still further increased before the accounts for the year are closed.

**The Wireless Retailers' Association.** — This Association, which was formed to protect the interests of retailers of radio apparatus and to maintain a high standard to the advantage of the buying public, has now produced a certificate of membership, which, it is hoped, will enable purchasers to distinguish members of the Association from non-members.

**The British Empire Exhibition, 1925.**—We have received an advance brochure setting forth the principal attractions at this year's Exhibition. Many of these were also features of the original exhibition. It is stated that the main exhibit in the Palace of Engineering will be a housing display, but there will also be a transport section organised by the railway companies, as well as exhibits of general engineering products.

## Lighting and Power Notes.

**Australia.**—Byron Bay (N.S.W.).—The Shire Council has received official approval to borrow a sum of £16,000 for an electricity scheme to serve Byron Bay and Bangalow. Current will be obtained from the Mullumbimby Council's hydro-electric plant.

Sydney.—The City Council will shortly be asked to consider the replacing of the most dangerous of the overhead h.p. mains by underground cables. The general manager, in a report to the town clerk, states that to replace the whole of the overhead h.p. mains by underground cables would cost more than £400,000.—*Tenders.*

**Barnard Castle.**—Proposed Electricity Scheme.—The question of undertaking the supply of electricity to the town is under the consideration of the Barnard Castle Gas Co. At the annual meeting of the company on March 26th, the directors reported that they had taken expert advice on the question. The capital cost was estimated at £14,685, and the estimated revenue for the second year was £3,460, leaving an estimated margin of profit of £990. The directors thought, however, that there would be difficulty at the present time in raising the required capital. It was decided to ascertain by a canvass of the town the number of probable electricity customers.

**Bexhill.**—Electricity in Bulk.—Following a suggestion by the Electricity Commissioners that the Corporation should in future obtain its electricity supply in bulk from Hastings, negotiations took place with the Hastings Corporation, and a quotation of £4 10s. per kVA and 8d. per kWh was received, but after negotiation and consultation by the Hastings representatives with the Commissioners these figures were reduced to £3 10s. and 4d. respectively. At a recent interview of Bexhill representatives with the Commissioners it was intimated that Bexhill must eventually obtain in bulk all the energy required, but that the Council would not be expected to discontinue generating at the Little Common station for the present. The Council has now approved the arrangements for a bulk supply of electrical energy from the Hastings Corporation.

**Birkenhead.**—Special Order.—The Electricity Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Corporation to supply electricity within parts of the urban district of Bebington and Bromborough.

**Bradford.**—New Plant.—The Corporation Estimates Sub-Committee approved, on March 26th, various schemes for public works involving over £60,000, including £16,000 for additional plant for the Valley Road power station, and a new feeder cable between the Valley Road and Bolton Road works.

**Burnley.**—New Plant.—The Electricity Committee has submitted a scheme to the Corporation for the installation of two 5,000-kW turbo-generators, with auxiliary plant, and four water-tube boilers. The land required will be obtained from the Gas Department. The estimated cost of the scheme is £142,200, and includes sums to be paid to the Gas Department for the land and the existing buildings which it is proposed to adapt. It was stated that the need for the extensions had been accelerated by the Corporation's having recently secured large consumers. The Corporation included in its Parliamentary Bill a provision to erect a new power station with a capacity of 12,000 kW, at a cost of £205,000. That proposal, however, has been withdrawn, and the Electricity Committee now proposes to apply for consent to extend the existing station. The proposal was approved by the Corporation.

**Clitheroe.**—Electricity Scheme.—The Corporation has entered into an agreement with the Lancashire Electric Power Co. to bring a bulk supply of electricity to the boundary of the town, and the Corporation will take it over for distribution. At the request of the Commissioners, application is being made for an Order to supply surrounding townships, and some arrangement is in prospect for parishes within the rural area. The Rural District Council has agreed to the Order provided the Corporation gives a compulsory supply within three years.

**Continental.**—France.—It is announced that the Minister of Public Works has granted a concession to the Forces Motrices de la Vienne to construct and work an electrical distribution network for public supply in the district extending from the Isle Jourdain to Roumazières, Saint Gervais, Exideuil, and Nieuil in the departments of Charente and Vienne.

The Syndicat de la Basse-Seille, embracing 35 townships in the department of the Saone-et-Loire, and two townships in the department of the Ain, has arranged with the Société des Entreprises Electriques du Centre for the supply by the latter of electricity for all purposes to the townships included in the trust.

Belgium.—Work is approaching completion on the erection of a 50,000-V transmission line from Merxem, near Antwerp, to Beerse and along the left bank of the river Scheldt, for the Société de l'Electricité de l'Escaut. In order to meet the growing demand the capacity of the central station is also being increased. During the past year a 10,000-kW turbo-generator was put in operation, and a set of 12,500 kW capacity is in course of erection, while a contract has been placed for the replacement of one of the old 7,000 h.p. sets, by a modern one of 12,500 kW. When the extensions in hand are completed the station will have a total capacity of 63,000 kW.

Rumania.—It is reported that the municipality of Jassy is negotiating with representatives of a German firm to rebuild the central power station which supplies the city with electricity. The sum involved is stated to be about 40,000,000 lei. The old equipment is to be replaced by 300-h.p. Diesel engines.

Spain.—Work is about to be commenced on the establishment of a large hydro-electric station to utilise the power of the river Alberche, near Madrid. The concession is held by the Sociedad Electro-Metalurgica Iberica, which is stated to have completed arrangements with the Power Securities Corporation, Ltd., of London, for the financing of the undertaking.

Switzerland.—Work is rapidly approaching completion on the construction of the large Chancy-Pougny hydro-electric power station, which is being constructed by the Société des Forces Motrices de Chancy-Pougny, of Geneva, and it is expected that the plant will be put in operation by July next. The turbines have been supplied by the Société des Ateliers des Charmilles, of Geneva, and Escher, Wyss & Co., of Zurich.

In order to provide the energy required for electric lighting and power purposes during the construction of the new hydro-electric station at Oberhasli, a transmission line is to be erected over the Brunig Pass. The power will be supplied from the station in Lucerne of the Central Switzerland Power Co., which is erecting the line as far as the Berne Canton border, the connection with the existing distributing system being made at Unteraa (Eiswil). The Berne Power Co. will be responsible for the erection of the remaining portion of the line.

**Dundee.**—Electricity Supply.—The Corporation Electricity Committee has decided to replace switches at Carolina Port generating station which have become inefficient, at a cost of £2,000.

**Halifax-Huddersfield.**—Interconnection Scheme.—On the recommendation of the Electricity Commissioners, a scheme is under review by the Halifax and Huddersfield Corporations for linking up the two electricity undertakings to meet the needs of extensions of supply instead of the proposed extension of the Huddersfield plant. The Commissioners pointed out that Halifax had recently made considerable extensions, and a scheme was submitted for linking up the two undertakings at an estimated cost of £84,000, towards which it was to be expected that assistance would be received from the Unemployment Grants Committee, and that if and when the Joint Electricity Authority for the West Riding (Aire and Calder) District is set up, the responsibility of the balance of the upkeep over capital would be taken over by the joint authority. The Electricity Committees of Halifax and Huddersfield are agreeable to the proposal and, failing agreement on the question of price for supply by one to the other, it is proposed that the Commissioners should arbitrate.

**Hamilton.**—Scheme Abandoned.—It is announced that the Town Council's application for sanction to extend its generating station has been withdrawn, and the inquiry that was to have been held on March 31st did not, therefore, take place.

**London.**—Battersea.—The Borough Council has received sanction to loans of £13,000 for mains and services, £2,000 for meters, and £7,741 for plant.

West Ham.—The Borough Council is to contribute £10,940 from the profits of the electricity undertaking to the relief of the rates.

**Maidstone.** — Electricity Supply. — The Rural District Council has decided to support the application of the Town Council for a Special Order to supply electricity in the rural district. The Corporation's application is being opposed by the Kent Electric Power Co.

**Manchester.**—Progress during February.—During February the new connections to the mains of the Electricity Department equalled 1,170 kW, bringing the total to 246,000 kW. In addition, applications were received in respect of a further 1,694 kW. The number of electric cookers actually on circuit rose from 611 to 633.

New Mains.—The estimated expenditure on new mains for 1925 is £39,400.

**New Zealand.**—WAITEMATA.—According to the *Industrial Australian and Mining Standard*, the reticulation of the Waitemata Power Board's area for the supply of electricity is the subject of a report by Messrs. Gauvain & McLeod, consulting engineers. The scheme involves authority to borrow £200,000, including £125,000 for the main scheme, to be put into operation as early as possible, and £55,000 for extensions. During the first year between £50,000 and £60,000 would be absorbed in capital outlay.

**Norwich.**—LOAN.—The Town Council is applying for sanction to a loan of £30,000 for mains and services.

**Price Reductions.**—Reductions in the charges for electricity have been made or recommended in the following districts:—

BATTERSEA.—Lighting: From 4½d. to 4d. per kWh. Power: From 1½d. to 1¼d. per kWh. Heating and cooking: Reduced to 1d. per kWh.

LONG EATON.—A general reduction of 7½ per cent.

OXFORD.—*Oxford Electric Co., Ltd.*—A general reduction of approximately 20 per cent.

**Plymouth.**—ELECTRICITY SUPPLY.—The Electricity Committee has been notified that the Electricity Commissioners have sanctioned the borrowing of £3,900 for the laying of a cable to Crownhill Barracks, also that Colonel T. C. Ekin, on behalf of the Commissioners, will hold an inquiry on April 15th into the Corporation's application for power to supply electricity in the Compton Gifford parish of the Plympton area.

**South-East Lancashire.**—ELECTRICITY ADVISORY BOARD.—The following items have been extracted from the reports of the Board's proceedings:—

*Breakdown in Supply.*—In view of the fire and breakdown at the Stalybridge power station, precautions to avoid breakdown in supply have been considered by a Special Committee, which has resolved:—(1) That where interconnection between two electricity undertakings is affected, it is desirable that such interconnection should take place at a point outside or detached from the main station of the receiving system. Where this course is not practicable, arrangements should be made at the receiving power station to isolate and sectionalise the interconnecting switchgear. In any event the above arrangement of isolating the switchgear should be adopted at the supply station. (2) That special precautions be taken against damage from fire to the cables running to and from an e.h.p. switchboard.

*South-East Lancs. Electricity District Order, 1923.*—It is recommended that the Board should apply to the Electricity Commissioners for an extension until December 31st, 1925, of the period within which a scheme should be submitted under S. 13 of the Order.

*Electricity Orders.*—The Board's support is recommended to the application of the Ashton-in-Makerfield Urban District Council for a Special Order to supply in the urban district. The proposals of the Cheadle and Gatley and Hazel Grove and Bramhall Urban District Councils to obtain Fringe Orders to supply in part of the Bucklow rural district and the parish of Woodford, respectively, were approved. It is reported that the Commissioners have made an order authorising Rochdale Corporation to supply in the urban districts of Norden and Wardle.

*Horwich.*—The Bolton Corporation has intimated that in view of the decision of the London, Midland and Scottish Railway Co. to take an electricity supply from the Lancashire Electric Power Co., the Corporation does not propose to supply electricity to the remainder of Horwich.

**United States.**—HYDRO-ELECTRIC DEVELOPMENT.—A licence covering the Priest Rapids project of the Washington Irrigation and Development Co. was authorised at a meeting of the Federal Power Commission held on March 2nd. The licence covers a 750,000-h.p. development in the Columbia River. The dam is to be 2½ miles long, and will form a reservoir with a storage capacity of 85,000 acre-ft. The primary power available at the site is 201,000 h.p. The initial installation will be 340,000 h.p.—*Power.*

**Willesden.**—LOAN SANCTIONED.—The Urban District Council has obtained sanction to borrow £5,100 in respect of a 1,000-kW set to be installed at the Salusbury Road sub-station.

The Electricity Committee has recommended the purchase of property adjoining the Salusbury Road sub-station at a cost of £8,350.

## Tramway and Railway Notes.

**Australia.**—MELBOURNE.—The Melbourne and Metropolitan Tramways Board proposes laying down a temporary tramway track for electric trams on St. Kilda Road during the conversion of the present cable tramway to electric traction. Negotiations have been entered into with the South Melbourne City Council in order to make a commencement with the work.

GEELONG.—Approval has been given by the Victorian Electricity Commission to the plans of the Melbourne Electric Supply Co. for extensions to the Geelong electric tramway system. The work is estimated to cost £70,000.—*Tenders.*

**Bradford.**—RAILLESS CARS.—The City Tramways Committee has been informed that, subject to Royal Assent, the scheme to establish a railless-car service on the route between Bradford and Clayton, a little over three miles, has been approved. It is intended that six railless cars shall be used, and the estimated cost of the installation is about £19,000.

The Estimates Sub-Committee, on March 26th, approved a Tramways Committee proposal to substitute a railless-car service on the Idle and Thackley routes in the place of the present tramway service, the track of which would otherwise have to be renewed.

**Continental.**—FRANCE.—According to the *Morning Post*, plans are under development for the transformation of the Gare St. Lazare, to which travellers by the Havre and Dieppe routes enter Paris. In view of the continually increasing traffic, it is proposed to construct an entirely new station for main-line trains at a point some two hundred or three hundred metres before the present station is reached, with direct access to the much less congested streets in that quarter. Simultaneously it is proposed to increase largely the area of the existing station and to create for suburban traffic an underground station below the existing one, which will serve all suburban lines as far as the city boundaries. The objections raised against the old Batignolles tunnel, which has now been removed, will not obtain in regard to the new underground line, as the trains utilised will be driven by electricity.

A railless-car service has recently been inaugurated by the Société Générale d'Entreprises between Modane and Lanslebourg, in the Department of Savoy, a distance of about 17 miles.

SWEDEN.—It is reported from Malmo that the A.S.E.A. of Vasteras has prepared a scheme for the conversion to electric traction of certain private railways in the district of Skane. Among others, the investigation carried out applies to the lines between Malmo and Simrishamn and between Malmo and Tralleborg.

AUSTRIA.—The electrification of the Austrian State lines, the total length of which amounts to 3,600 miles, is progressing. The stretch between Landec and Bludenz, in Vorarlberg, will be electrically operated this spring, while the electrification of the line from Bludenz to the Swiss frontier will be completed early next year. The electrification of the lines from Innsbruck to the Brenner and Kufstein respectively and of the part of the Southern Railway from Gloggnitz across the Semmering Pass to Mürzzuschlag, in Styria, will follow.

**Grimsby.**—PURCHASE OF CARS.—The Corporation, which is taking over the tramway in the borough on April 2nd, is to purchase from the Sunderland District Tramways Co. ten cars at a cost of £620 each. The new scale of fares which will come into operation when the Corporation take over the undertaking shows a considerable increase on the present scale, but an innovation will be the introduction of penny stages.

**India.**—RAILWAY ELECTRIFICATION.—Sir Charles Innes, in presenting the railway budget for 1925-26 to the Legislative Assembly, said that the Government was providing Rs. 103 lacs for the electrification of the Great Indian Peninsula Suburban line and Rs. 77 lacs for the electrification of the Bombay, Baroda, and Central India suburban line into Bombay.—*Indian Engineering.*

**Southern Railway Electrification.**—The first section of the new electrified extensions of the Southern Railway—from Victoria to Coulsdon North and Sutton—was to be inaugurated on Wednesday last. Over 100 additional new coaches will be put into service, and there will be a 20-minute service to Sutton and Coulsdon alternately, making a 10-minute service as far as Selhurst. The cost of this section was about £680,000, and 82 additional miles of electrical track have been laid. The Guildford and Dorking (South-Western) and Orpington (South-Eastern) sections will be completed for electrical operation in July next.

**United States.**—RAILWAY ELECTRIFICATION.—Another step toward the electrification of American railroads has been taken by the decision of the Illinois Central to electrically operate 37 miles of suburban track. The area in which steam will be displaced lies within the city of Chicago and its immediate neighbourhood, extending south for 28 miles from the famous Loop, and the project calls for the first operation of electric trains by July 1st, 1926. The electrical equipment now being ordered represents an expenditure of $2,600,000. Each motor-car will be equipped with a special motor-generator set for lighting the cars, this equipment to be provided by the General Electric Co. of America. The electrical zone will operate 120 motor-cars and 120 trailers in units consisting of one motor-car and one trailer; each unit will be equipped with four motors, of 250 h.p. each, so that a ten-car train will be nominally rated at 5,000 h.p.

The New York Central Railroad Co. has placed orders with the General Electric Co. for seven 100-ton electric switching locomotives and two 170-ton electric road freight locomotives, to be put in service on the electrical division at New York City and vicinity. These locomotives are to be tried in anticipation of the future electrification of the West Side freight tracks running from Spuyten Duyvil to Canal Street in the city of New York. The locomotives, which are being built jointly by the General Electric Co. and the American Locomotive Co., will be equipped for both third rail and overhead collection of current. The specifications for the switching locomotives provide for handling a 1,500-ton trailing train, consisting of 75 per cent. empties and the balance of loaded cars, at a speed of not less than 25 miles per hour. The road locomotives will handle a 3,000-ton train of the same general make-up, at speeds of not less than 32 miles an hour.

# Telegraph and Telephone Notes.

**India.**—Radio Direction-Finding Stations.—The Department of Posts and Telegraphs in India is investigating the practicability of erecting radio direction-finding stations at certain ports in India. The directional receiver installed at Karachi as an experimental measure has proved successful, and as soon as the reliability of the service is completely proved a charge of Rs. 5 per bearing is likely to be made. Another experimental receiver is being installed at Butcher Island, Bombay, but it appears that a more suitable site will be found for it.

**New Atlantic Cable.**—British Contract.—Mr. Newcomb Carlton, president of the Western Union Telegraph Co., arrived in New York on March 28th, and announced that he had signed a contract with a British cable-laying company to lay a new cable in the North Atlantic between New York and London, to be completed in 1926, with a capacity of 100 million words per year.

**Persia.**—New Radio Station.—On March 25th the Prime Minister, Riza Khan, opened the first wireless station to be erected in Persia.

**Post Office Estimates.**—In the last of the detail estimates for the coming financial year an increase of £2,046,731 is principally due to a rise of £1,876,330 in the Post Office estimate. A sum of £4,561,898 appears for the development of the telephone system, an increase of £632,152. Wireless broadcasting is set down at £350,000, an increase of £50,000.—*The Times.*

Mr. H. E. Powell-Jones, secretary of the Telephone Development Association, points out, says the *Financial Times*, that these figures have reference only to salaries paid and not to total Post Office expenditure. The figure, for example, of £4,561,898 refers to salaries to be paid to the staff engaged in this particular branch. This year's estimates of capital expenditure on development have not yet been published, but they will be many times this amount, and considerably in advance of any previous year.

**Submarine Cable Companies.**—London Association.—It is understood that the principal British and other submarine cable companies are to form an association, on the same lines as the Railway Companies' Association, to deal with matters which are of common interest to them all. The proposed association is not intended to be regarded as a trust or amalgamation of any sort, and will not be hostile to any method of communication. Mr. Frank J. Brown, C.B., C.B.E., who recently retired from the Post Office after 38 years' service, has been appointed adviser to the Association.

**The Telephone Service.**—Public Kiosks.—The concrete structures erected in the streets by the Post Office as telephone kiosks failed, it seems, to satisfy local authorities. The Post Office accordingly applied to the newly-formed Royal Fine Arts Commission to arrange and judge a competition for a new design. As a result, a type designed by Sir Gilbert Scott, R.A., has been accepted. It will actually be constructed of cast iron sections assembled on the spot. The door and both sides have lattice windows, and there will be electric light inside.

Morecambe.—The Town Council has given permission to the Post Office to erect public telephone kiosks at four positions on the sea front and near the head post office in Victoria Street. In view of this fact, the Corporation Fire Brigade Committee has decided not to proceed with the proposed installation of electric fire alarm boxes, as the kiosks will be open night and day.

New Exchange.—A new telephone exchange was to be opened at Mill Hill this week.

# Radio Notes.

**Australia.**—Parliamentary Debate Broadcast.—For the first time the proceedings at the opening of a short session of the New South Wales Parliament on March 24th were broadcast, and the experiment was most successful.

The transmitting station used was 2FC, in Sydney, which has a wave-length of 1,100 metres, a power of 5 kW, and is owned by Messrs. Farmers, Ltd.

**Brazil.**—Broadcasting Station Proposed.—A campaign has been initiated for the purpose of providing the needed capital for the construction of a broadcasting station at Sao Paulo.

**France.**—International Congress.—An international congress of wireless amateurs is to be held in Paris from April 16th to 20th, when various questions will be discussed, including a proposal to form an International Wireless Union. A fee of 25 fr. will be charged for admission to one section of the congress and 40 fr. to the other section. The offices of the Congress are at 2, Rue de l'Echaudé-St. Germain, Paris.

**India.**—Licences.—The Government of India, in a *communiqué*, states that the possession of any radio apparatus for transmitting or receiving, whether in the form of a complete set or merely of component parts, is illegal, except in accordance with a licence issued under the Indian Telegraph Act. A broadcast receiver licence can be obtained on application, but if a person desires to work a transmitting set or to import apparatus into British India, an application must be made in writing to the Director-General of Posts and Telegraphs, Wireless Branch, Simla. The annual fee is Rs. 10 only.

**London Station.**—Second Station Proposed.—The *Evening Standard* learns that the B.B.C. favours the idea of erecting a second station in London, in order that it might provide listeners with a class of programme different from that of 2 LO. The proposal is definitely under consideration, but the most serious matter which the B.B.C. directors have to face is the cost of a complete new station.

**The Wireless League.**—Insurance Scheme.—The Hon. Sir Arthur Stanley, president of the Radio Association, has been appointed chairman of the Executive Committee of the League, and presided at the mass meeting in London on March 25th. To those who sent in the enrolment form before March 31st the one shilling subscription confers membership and insurance benefits as follows:—Set insured against damage by fire or lightning up to £25 and free insurance against third-party risks (persons or property) up to £100.

# Contracts Open and Closed.

*(The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

## Open.

**Aberdeen.**—April 29th. Electricity Department. Four water-tube boilers, with superheaters, economisers, draught fans, steel chimneys, piping, and accessories; also dismantling and re-erecting certain existing boilers. (March 27th.)

**Adwick-le-Street.**—April 6th. Urban District Council. Sub-station equipment, h.p. and l.p. joint boxes and cables, distribution pillars, &c. (March 6th.)

**Amersham.**—April 6th. Board of Guardians. Electric lighting installation at the Institution. Mr. E. E. Fetch, architect (returnable deposit of £1 1s.).

**Ashford.**—April 6th. Electricity Department. Transformers. (March 20th.)

**Australia.**—Sydney.—June 4th (extended from May 14th). Postmaster-General's Department. Accumulator and counter e.m.f. cell batteries.*

June 11th. Motor-generator sets for the Randwick, Waverley, Gordon, and City East telephone exchanges.*

Melbourne.—May 6th. Victoria Government Railways. High-speed turbine lathe, portable petrol engine-driven electric welding plant.*

**Belgium.** — April 20th. Deputation Permanente de la Province de Limbourg, Hasselt. Equipment of 20 transformer cabins and the supply of transformers, with accessories, electricity meters, &c. Particulars (17 fr.) from Bureaux du Service Provincial d'Electricité, 27, Avenue Bamps, Hasselt.

**Bristol.**—April 16th. Electricity Department. One 7,000-kW turbo-alternator, with condensing plant and auxiliaries. (March 20th.)

**Chile.**—Santiago.—July 1st. Ports Commission. Eight electrically-operated travelling portal cranes for the Port of San Antonio.*

**Dartford.**—April 6th. Electricity Department. Six or twelve months' supply of small steam coal. (March 27th.)

**Dublin.**—April 6th. Borough Commissioners. Electric wiring of 180 houses at Marino. Particulars (21s.) from the City Treasurer's Office, Lord Edward Street, Dublin.

April 10th. Borough Commissioners. E.h.p. and l.p. cables for one or two years. Forms of tender (21s.) from the City Electrical Engineer, Fleet Street, Dublin.

**Edinburgh.**—April 10th. Electricity Supply Department. Steam, feed, and circulating pipework, with valves. (March 27th.)

April 13th. Underground insulated cables, conduits, pavement box frames and covers, house service fuse boxes. (See this issue.)

**Egypt.**—Cairo.—May 2nd. General Manager, Egyptian State Railways, Telegraphs and Telephones. 8,000 metres of submarine cable, 45 tons h.d. copper wire, &c., for telephones, 19,630 metres of cable. Inspecting Engineer in London.

**Glasgow.** — April 6th. Education Authority. Electric lighting installation at St. David's School, Townhead. Specifications, &c., from Education Offices, 129, Bath Street.

**Gravesend.**—April 20th. Electricity Department. 5,000-kW turbo-generator, condensing plant, switchgear, and straight-tube water-tube boiler. (March 27th.)

**India.**—April 7th. India Store Department. Telephone repeaters. (March 20th.)
April 17th. India Store Department. Gutta-percha cable. (See this issue.)
BOMBAY.—April 20th. Bombay, Baroda, and Central India Railway. Supply of cables. (March 27th.)

**Letterkenny (Co. Donegal).**—April 13th. Tirconaill Mental Hospital. Oil-engine-driven generator, switchboard battery, &c., electrical wiring of buildings, &c. (See this issue.)

**London.** — BERMONDSEY.—April 8th. Borough Council. Electrical installation at the laundry and engine room of the new baths and wash-houses, Grange Road. (See this issue.)
H.M. OFFICE OF WORKS.—April 24th. Supply of mechanical and electrical engineering labour during three years in Leeds, Newcastle, and Southampton. (See this issue.)
METROPOLITAN ASYLUMS BOARD.—April 22nd. Leavesden Mental Hospital, King's Langley. Installation of four new Lancashire boilers, economiser, brickwork settings, laundry machinery and plant, electrical generating plant, motors and power wiring. April 27th. General engineering work, including steam plant, steam and condensing mains, heating and h.w.s. mains and apparatus, electric motors for deep well engines and laundry, &c. (See this issue.)

**Manchester.**—April 9th. Electricity Committee. 6,600-V sub-station switchgear, 6,000-kVA and 500-kVA static transformers. (March 27th.)

**Middlesbrough.** — April 15th. Electricity Department. Twelve months' supply of cables and a.c. meters. (See this issue.)

**Richmond (Surrey).**—April 20th. Education Committee. Installation of electric lighting at the Darell Road Council school. (March 27th.)

**Southampton.** — April 28th. Electricity Department. 10,000-kW turbo-alternator, with condensing plant; 50-ton electrically-operated travelling crane; 2,000-kW rotary-converter set, with transformer; starting panel, &c.; e.h.p. switch cubicles, control panels, indicating diagrams, &c.; d.c. switchgear; turbine boiler feed pump. (March 27th.)

**Truro.**—April 13th. City Council. Provision of an electric lighting scheme for the city area. (March 27th.)

**Uruguay.** — MONTEVIDEO. — May 12th. State Electricity works. H. and l.p. cables, telephone cables, junction and terminal boxes.*
April 15th. 45,700 to 56,000 metric tons of fuel oil.*

**Walthamstow.** — April 8th. Electricity Department. One 7,000-kW turbo-alternator and condensing plant, one 1,000-kW motor converter, l.p. cables, and v.i.r. wires. (March 20th.)

**York.**—April 24th. Electricity Department. Two 25,000-lb. water-tube boilers, economisers, fan chimneys, &c., one 1,500-kW rotary or motor converter, with switchgear, one 1,000-kW motor-generator and switchgear. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

## Closed.

**Bexhill.**—Electricity Committee. Accepted:—
Converting plant.—Bruce Peebles & Co., Ltd.

**Birkenhead.**—Electricity Committee. Accepted:—
500-kW automatic rotary converter (£4,186).—Metropolitan-Vickers Electrical Co., Ltd.
Cable (£2,811), Macintosh Cable Co., Ltd.; (£1,150), W. T. Henley's Telegraph Works Co., Ltd.

**Bournemouth.**—Health Committee. Accepted:—
Electric lighting at hospital (£2,196).—Aish & Co.

**Brighton.**—Board of Guardians. Accepted:—
Electrical fittings (£133).—Adams Bros.
Turbo-alternator (£22,020), surface condenser (£6,640).—Metropolitan-Vickers Electrical Co., Ltd.

**Chorley.**—Town Hall Committee. Accepted:—
Completion of electric lighting installation at Town Hall.—Nelson Engineering Co., Ltd.

**Croydon.**—Electricity Committee. Recommended: —
Four switch panels (£545); two switchboards of 4 trucks (£938); one switchboard of 10 cubicles (£350); one switchboard of 8 cubicles (£280).—English Electric Co., Ltd.
Four banks of 500-kW Scott-connected transformers (£1,968).—British Electric Transformer Co., Ltd.
10,000-kW turbo-alternator (£38,648).—Metropolitan-Vickers Electrical Co., Ltd.

**Guildford.**—Electricity Committee. Accepted:—
400 plates for storage battery (£445).—D.P. Battery Co., Ltd.

**Halifax.**—Tramways and Electricity Committee. Accepted:—
Two duplex water-cooling towers at the electricity works (£6,450).—Peter Brotherhood, Ltd.

**Ilford.**—Electricity Committee. Recommended:—
Electric tractor (£510).—Electromobile, Ltd.
Switchboard (£211).—Cecil Hodges & Co., Ltd

**London.**—LONDON, MIDLAND & SCOTTISH RAILWAY. Co. Accepted:—
Gasfilled Fullolite electric lamps.—Edison Swan Electric Co., Ltd.
POPLAR.—Health Committee. Accepted:—
Electrolytic plant (£900).—Mather & Platt, Ltd.

STEPNEY.—Electricity Committee. Recommended:—
5,200 fuse boxes (£746).—W. T. Henley's Telegraph Works Co., Ltd.
Two tons sheet lead (£99).—G. Farmiloe & Sons, Ltd.
Cables:—

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|---|---|
| **W. T. Henley's Telegraph Works Co., Ltd.** ... ... | **£11,974** |
| British Insulated & Helsby Cables, Ltd. ... ... ... ... | 12,060 |
| Macintosh Cable Co., Ltd. ... ... ... ... ... | 12,132 |
| W. T. Glover & Co., Ltd. ... ... ... ... ... | 12,153 |
| Pirelli-General Cable Works, Ltd. ... ... ... ... | 12,171 |
| Western Electric Co., Ltd. ... ... ... ... ... | 12,214 |
| Siemens Bros. & Co., Ltd. ... ... ... ... ... | 12,219 |
| Callender's Cable & Construction Co., Ltd. ... ... ... | 12,417 |
| Hackbridge Cable Co., Ltd. ... ... ... ... ... | 13,172 |

The Siemens & English Electric Lamp Co., Ltd., has received a contract from the Admiralty for a large quantity of electric lamps for use on H.M. ships; also one from the Metropolitan Water Board for gasfilled lamps for 12 months.

**Manchester.**—Electricity Committee. Accepted:—
Two 160-kW d.c. traction boosters, switchgear, &c.; four automatically-controlled 600-amp., 3-wire, d.c. balancers, switchgear, &c.—Lancashire Dynamo & Motor Co., Ltd.
Two 750-kW automatic rotary converters.—Metropolitan-Vickers Electrical Co., Ltd.
One 750-kW remote-control rotary converter (remote-control equipment supplied by Bertram Thomas).—Mather & Platt, Ltd.
Two 750-kW motor converter sets.—British Thomson-Houston Co., Ltd.; Bruce Peebles & Co., Ltd.
250 street lanterns.—Wardle Engineering Co., Ltd.
18 double-pole circuit breakers, 25 1,200-amp. d.c. feeder panels.—J. G. Statter & Co.
Five 2,500-amp. knife switches, mounted complete with panels.—Ferguson, Pailin, Ltd.
One 6,000-amp. double-pole circuit breaker.—Whipp & Bourne, Ltd.
Three 1,200-amp. d.c. booster panels.—Park Royal Engineering Works, Ltd.
75 voltmeters and ammeters.—Bertram Thomas.

**St. Helens.**—Electricity Committee. Accepted:—
Two 35,000-lb. per hour water-tube boilers, with economisers, fan, chimney, grit arrester, pipes, &c.—Babcock & Wilcox, Ltd.

**Salford.**—Health Committee. Accepted:—
Installation of an inter-communication telephone at Ladywell Sanatorium (£293).—E. M. Evans & Son, Ltd.

Tramways Committee. Accepted:—
Materials for 12 months:—
Armature coils, &c.—Manchester Armature Repair Co., Ltd.
Gear and pinion wheels.—British Hele-Shaw Patent Clutch Co., Ltd.
Steel tires.—Hadfields, Ltd.; Steel, Peech & Tozer, Ltd.; Brown, Bayleys Steel Works, Ltd.
Brake blocks.—National Rail & Tramway Appliance Co., Ltd.; J. Needham & Sons.

**South Africa.**—Messrs. Johnson & Phillips have received orders for switchgear: From the South African Railways, for 25 draw-out truck-type and 3 stationary cubicles; and from the Public Works Department, for 6 draw-out truck-type and 21 stationary cubicles.

**Stoke.**—Electricity Committee. Accepted:—
E.h.p. truck-type switchgear (£1,053); station transformers (£303).—Metropolitan-Vickers Electrical Co., Ltd.
Mains and cables for the year.—Callender's Cable & Construction Co., Ltd.

**Wimbledon.**—Electricity Committee. Recommended:—
Turbine-driven boiler feed pump (£317).—J. P. Hall & Sons, Ltd.
Switchgear for sub-station (£1,004); shields and steel casings (£224).—English Electric Co., Ltd.
Switchgear (£935).—Ferguson, Pailin, Ltd.
Rebuilding portion of boiler house (£1,250).—Vickers-Spearing Boiler Co., Ltd.

## Forthcoming Events.

**Electrical Power Engineers' Association (Southern Division).**—Friday, April 3rd. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 7 p.m. Lecture on "Power Station Engineering Under Tropical Conditions in Southern China," by Mr. W. E. Jones.

**Institution of Engineers-in-Charge.**—Saturday, April 4th. At the Holborn Restaurant, London. At 6.30 p.m. Annual dinner.

**Institution of Electrical Engineers.**—INFORMAL MEETING.—Monday, April 6th. At the Institution, Victoria Embankment, W.C. At 7 p.m. Discussion on "Insulation Problems in High-voltage Engineering," to be opened by Mr. A. Collins.

**(Irish Centre, Dublin).**—Thursday, April 9th. At Trinity College, Dublin. At 7.45 p.m. Paper on "Automatic Telephony," by Mr. P. J. Hayes.

**(Scottish Centre).**—Tuesday, April 7th. At 207, Bath Street, Glasgow. At 7.30 p.m. Paper on "The Economic Aspect of the Utilisation of Permanent Magnets in Electrical Apparatus," by Mr. E. A. Watson.

**(Western Centre).**—Monday, April 6th. At the Guildhall, Gloucester. Paper on "Radiators and Heating, with Special Reference to Material," by Mr. S. T. Allen.

**(Sheffield Students' Section).**—Wednesday, April 8th. At the University, Sheffield. Smoking concert and annual general meeting.

**Institute of Transport.**—Monday, April 6th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 5.30 p.m. Address on "The Lessons of the Indian Flight," by Air Marshal Sir W. Sefton Brancker.

**Society of Engineers.**—Monday, April 6th. At Burlington House, W. At 5.30 p.m. Ordinary meeting.

**Roentgen Society.**—Tuesday, April 7th. At 33, Welbeck Street, W. At 8.15 p.m. Ordinary scientific meeting.

**Electrical Trades Commercial Travellers' Association.**—Wednesday, April 8th. At St. Bride's Institute, E.C. At 7 p.m. General meeting.

**Radio Society of Great Britain.**—Wednesday, April 8th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 6 p.m. Informal meeting. Lecture on "Home-made Wireless Components and Sets," by Mr. E. C. Atkinson.

**Edinburgh Electrical Society.**—Friday, April 10th. At the Philosophical Institution. At 8 p.m. Paper on "Some Considerations in the Installation of Transformers," by Mr. D. S. Ellis.

# Notes.

**International Railway Congress.**—The tenth session of this Congress is to be held at the Institution of Civil Engineers from June 22nd to July 4th. Among the subjects which have been set down for discussion are electric locomotives, suburban services, and the reduction of traction costs.

**An Italian Electricity Commissioner.**—A novel departure has been made in Italy by the appointment of an official to supervise "the rational employment of electric energy." His duties cover 14 of the principal provinces, and consist in co-ordinating all operations to ensure the continuity of production, the best utilisation, and the eventual restriction of consumption of electric energy in cases of necessity. Ample inspection and controlling powers are vested in the Commissioner.

**Electricity in the Home.**—A lecture arranged by the Women's Electrical Association, on behalf of the Worcestershire Federation of Women's Institute, was given by Miss Partridge on March 23rd, at the Shire Hall, Worcester, on "Electricity in the Home." Much interest was displayed in the schemes for rural electrification which are now being carried out by the Shropshire, Worcestershire, and Staffordshire Electric Power Co., most of the women present having come from country districts.

**Electrical Progress in Sweden.**—Some official figures recently issued by the Swedish Government relating to the industrial advance of the country during 1923 afford a striking indication of the progress of the utilisation of electricity in that country. It is stated that the total output from the various generating stations in Sweden amounted during that year to 2,956 million kWh, an increase of 273 million kWh over the total for 1922, while, as contrasted with 1913, when the aggregate production was only 1,449 million kWh, the output shows an advance of over 100 per cent.

**The Manchester Steam Users' Association.**—The annual general meeting of the members of the above Association was held on March 24th, when the annual report of the committee of management for 1924 was presented for adoption, and the committee of management for the ensuing year elected. The report shows that the number of members of the Association on December 31st, 1924, was 1,794; the number of works and boilers under inspection was 5,151 and 11,736 respectively; and the revenue for the year £43,304 5s.

**National Institute of Industrial Psychology.**—The fourth annual meeting of the above Institute was held on Wednesday, March 25th, when the annual report and statement of accounts for the year ended December 31st, 1924, were presented. The report showed the very satisfactory balance of income over expenditure of £163 for the year under review, making a total balance of £669. The success of the year is reflected in the report of an increase of 49 per cent. in the income from "fees for general services." Important progress was made during the year in the investigation into two improved methods of selecting employés, and the use of the Institute's engineering tests was greatly extended. Firms are now asking the Institute to train members of their staffs so that they may apply vocational tests under the Institute's supervision; and educational authorities are asking the Institute to provide courses of instruction in the use of mental tests for their teachers. Mr. Cecil Fry, of Messrs. J. S. Fry & Sons, Ltd., in a letter to *The Times*, said that the mental tests of the Institute formed a sound basis for vocational selection which was successfully applied to all groups of workers in his firm.

**Electrical Schemes in Baden.**—The Baden Electricity and Water Economy Board, comprising representatives of the towns in this State, the large power works and other interested groups met at Carlsruhe on March 16th and 17th, when Dr. Kohler, Baden Minister of Finance, presented a survey of the schemes in progress for the development of the water powers in the State. He also mentioned that negotiations were proceeding with a view to the establishment of a connection between the Baden electricity works and the 200,000-V network of a lignite power station on the Lower Rhine. In the south the Baden bus-bars would be joined to the Swiss network. It was expected that by the end of this year an efficient electrical transmission line would be established extending from the Central Alps of Switzerland right through Baden to the site of the lignite deposits on the Lower Rhine.

**Quick-hardening Cements for Road Repairs.**—Since the trial was made in December last of re-laying a section of Piccadilly with a British rapid-hardening cement side by side with a similar type of French cement, a series of tests has been made at the City and Guilds Engineering College and the published results, coupled with the success of the Piccadilly trial, seem to have made a deep impression on the minds of borough engineers. In the recent re-laying of Sloane Street, the same British cement, *viz.*, "ferrocrete," was employed, and for the re-laying of Westminster Bridge the London County Council engineer specified the use of ferrocrete. "Lightning," a similar cement, was specified by the City engineer for the re-laying of Gresham Street, and the same brand of aluminous cement was used for Victoria Street, Belfast, where the whole work of reconstructing the tramway track was carried through within a week, the time saved being estimated as three weeks.

**Steamship Conversion.**—In a paper ("Conversion of s.s. *Bintang*"), read before the N.E. Coast Institution of Engineers and Shipbuilders on March 27th, Eng. Lt.-Comdr. L. J. Le Mesurier, R.N., dealt generally with the conversion of steamships to motor-ships (Diesel), and described in detail the conversion of the s.s. *Bintang*. A 3,600-b.h.p. Sulzer 2-stroke engine is installed in this ship, and it is interesting to note that this is the largest Diesel engine so far constructed for a single-screw installation. Two 50-kW auxiliary generating sets are driven by two-cylinder Sulzer auxiliary Diesel engines. The original steering gear has been adapted to work on the "Ward Leonard" system, which has been developed by Messrs. Laurence, Scott & Co., and already applied to a number of ships in this country. It was possible to apply this system in a very convenient manner to the steering gear in the *Bintang*. The original steam engine has been removed and replaced by an electric motor, which is controlled on the "Wheatstone bridge" principle, which is the essential feature of the "Ward Leonard" system. In case of emergency or for any other reason it is, however, possible to remove the motor and replace the steam engine in a matter of a few hours, and thus operate the steering gear by steam.

The author said that the uneconomical performance of steam auxiliaries in port was receiving a good deal of attention and proposals had been considered, and were in some cases being adopted, for equipping steamships with Diesel-electric engine-room auxiliaries and deck machinery.

**Appointments Vacant.**—Assistant shift charge engineer for the Borough of St. Marylebone Electricity Department. Jointer for the Farnworth Urban District Council electricity works. Meter repairer for the Fulham Borough Council Electricity Department. Two meter mechanics for the Southend-on-Sea Electricity Works. (See our advertisement pages to-day.)

**Church Loud-Speakers.** — On account of the difficulty encountered by preachers in making themselves heard in all parts of the Cathedral of Notre Dame in Paris, the Dean and Chapter are having a microphone placed in the pulpit and loud-speakers in different parts of the building, including the three galleries.

**The Employment of Ex-Officers.**—The Officers' Benevolent Department of the British Legion took over from the Ministry of Labour as from April 1st the responsibility of re-settling in civil life ex-officers and other ex-Service men of similar educational qualifications, and of completing the work of the Appointments Branch so far as funds permit. The Department has for this purpose received an unconditional grant from the Ministry, but it is anticipated that this will be insufficient to cover the bare office expenses. The British Legion therefore appeals for the continued assistance of business men which has been of such service in the past. The Electrical Review will continue to give the facilities which have for some time been afforded to the Appointments Branch in connection with its endeavour to obtain positions for ex-officers.

**R.A.F. Electrical School.** — A branch of the Royal Air Force about which little has been heard is that concerned with wireless communication within the Force and in co-operation with other units, yet it is one of importance. In Iraq, for instance, part of the system of control without occupation lies, says *The Times*, in dumping down from the air little wireless stations in the scattered parts of the country. These can call up the main station at any time, and within a few hours aeroplanes can rush over troops or remove a station and its *personnel* from danger. Thus communication with political officers is maintained by a few wireless operators, and a portable set of small compass, with the air power in the background instead of a small garrison of ground troops being maintained on the spot. Hence the importance of Flower Down, the electrical and wireless school of the Royal Air Force, situated some miles outside Winchester. With Halton and Cranwell, it forms an integral part of the expanding system of training the men of the Force. Flower Down may be proud of the fact that it had no failures in the first group of lads due to pass out after their three years' course. There is barrack accommodation for about 1,200 boys and men, and at present there are about 900 under training, either as operator-mechanics, as operators, as electricians, or as instrument repairers. This number is expected to rise to about 950 by April, and from then onwards there should be a steady output each year of boys and men to meet the needs of the Force. It was from these classes that 73 lads passed out on March 4th, after a formal prize-giving, at which the Commandant explained that of the January, 1922, entry of 79 there were 73 to pass out. Owing to the technical nature of the work a high educational standard was required, and boys were selected, therefore, from those who passed high up in the entrance examinations of the Air Force. Every operator who was passing out had successfully operated his instruments from the air; the staff of civilian instructors had been increased.

**Electric Coal-cutting in Austria.** — Hitherto the use of electric coal-cutting machines has not been permitted in the collieries in the Ostrau-Karwin district of Austria, owing to the alleged danger from sparking. As a result of inquiries in England and Germany, the Witkowitz Steinkohlengruben Gesellschaft has applied for permission to employ them in its mines, and we learn that it has been agreed that trials with electric coal cutters shall be made in the Oskar pit of the company at Petershofen. These will be watched by Government experts, who will later report on the subject.

**The Development Fund.**—The accounts of the Development Fund for 1923-24, just issued, show that of the loan of £74,001 advanced to the Hereford Corporation for the extension of electricity supply to agricultural districts in 1920-22, £7,118 has been repaid, leaving £66,883 outstanding. The principal and interest were one year in arrear at March 31st, 1924.

**Educational.**—The Polytechnic, 309, Regent Street, W.—A course of 12 lectures in Illuminating Engineering will be given on Monday and Wednesday evenings from 6.30 to 7.30 p.m., commencing April 20th. Fees for the course, 10s. 6d. Further particulars can be obtained from the Director of Education. (See our advertisement pages to-day.)

**The Shannon Hydro-Electric Scheme.** — In view of the favourable report on this scheme given by the Government experts appointed to examine the proposals recently put forward, the Dail Eireann was yesterday to be asked to resolve that it is expedient that the necessary legislation be introduced at the earliest possible date to enable the proposals to be carried into effect. It has been obvious so far that the intention of the Executive Council (the Cabinet) is to make the undertaking a State enterprise.

In reply to a question in the Dail, Mr. McGilligan, the Minister for Industry and Commerce, said that it was not practicable to place the Shannon scheme plans on view for public inspection; there was only one set of plans available, and it was in use in his department, and by others concerned in the work. He was satisfied that the report already furnished on the scheme gave engineers sufficient details upon which to found criticism. Owing to the examination to which the Shannon scheme had been subjected there was no necessity, as in the case of private Bill legislation, for making the plans public. Unless he had some better evidence of the desirability of doing so, he did not intend to have further sets of plans made available for public inspection.

The Electricity Supply Association of Ireland, and the Irish Farmers' Union, are calling for careful consideration before so costly and elaborate a scheme is proceeded with, and Sir John P. Griffith, an eminent engineer and a member of the Senate, is asking the House to adopt a resolution for the appointment of a technical committee to examine the plans of the scheme before any definite steps are taken to put the scheme into operation. Several leading Irish engineers have written to the Press urging delay. A number of these gentlemen are interested in the rival river supply schemes for electricity supply in the Dublin area and in East Leinster generally. Sir John P. Griffith is also interested in furthering the Liffey proposal.

**Recent Developments in the Nitrogen-fixation Industry.**—An interesting article under this heading appears in *Nature*. Since the war the processes for fixing atmospheric nitrogen have been further developed, and the present yearly production of fixed nitrogen is approximately 500,000 metric tons, three-quarters of which is made in Germany. The arc process, the lineal descendant of Cavendish's initial discovery in 1783, now contributes only a relatively small proportion of the total production (about 36,000 m.t.), its high power requirement rendering it uneconomical.

Fixation by means of calcium carbide was developed enormously during the war, but the present outlook for this method is not promising: calcium cyanamide has not come up to expectations as a nitrogenous fertiliser, the power requirement being three to four times greater than that of the direct synthetic-ammonia process, although only one-fifth of that of the arc process.

About 65 per cent. of the world's supply of fixed nitrogen is obtained by the Haber process, which involves the direct union of nitrogen (from liquid air) and hydrogen in the presence of a catalyst at various temperatures. In this process the cost of producing and purifying the hydrogen is a dominating factor. In Germany it is prepared from water-gas (Bosch process), in France by fractionating coke-oven gas (Claude process), and in Italy by electrolysing water (Casali and Fausser processes). Electrolytic hydrogen is very pure, but its production is only feasible where cheap power is available. Other methods of producing the hydrogen are practised in America and elsewhere.

Other important factors in the Haber process are the choice of catalysts and the mode of marketing the ammonia. In the Fixed-Nitrogen Research Laboratory of the United States Government, improved catalysts have been made which, it is expected, will reduce the cost of ammonia production by one-half; working on a small scale, at 1,500 atmospheres pressure, nearly 80 per cent. of a nitrogen-hydrogen mixture was converted during a single passage through the catalyst.

Fixed nitrogen is being increasingly used as ammonia for cold-storage plant, as cyanide for gold extraction, and as nitro-cellulose for making celluloid, artificial leather, and similar products.

**Town Council Visit to Electricity Works. Barnsley.**—To mark the 25th anniversary of the opening of the Barnsley electricity undertaking, an official visit of inspection was made by the Mayor and Corporation to the electricity works on Thursday, March 19th. The visitors assembled in a marquee erected in the yard and after being welcomed by the chairman of the Electricity Committee, Mr. Councillor Foulstone, the guests were escorted in small parties round the works by the staff of the Electricity Department. Each Department of the works, boiler house, turbine house, &c., was visited in its turn, and after the tour the new 3,000-kW turbo-alternator was started up by the chairman. An interesting brochure, prepared by the borough electrical engineer, Mr. E. A. Barker, was presented to each of the guests. The brochure gives the history of and the progress made by the Electricity Department since 1900. It is well illustrated and contains some interesting "progress" pictures denoting the increase of consumers, plant, and illumination per kWh, and the reduction of coal consumption, from 1900 to 1924. The total capacity of the station is now about 16,000 h.p. The balance sheet of the undertaking for 1924 shows a profit of £8,384, the total revenue being £49,662, representing 4,694,480 kWh sold to 2,515 consumers.

**Television Demonstration.**—Although in its primitive stages, the Baird system of television interested many who attended the demonstrations given by Mr. J. L. Baird, the inventor, at Selfridge's last week. The principle of this system is the production of a pulsating current in a light-sensitive cell brought about by interrupted light being thrown on the cell. Reflected light from the object of transmission is thrown across the cell by means of a series of lenses arranged in spiral form and revolving in the path of the light rays, the rays being interrupted by means of a serrated disk revolving so as to cut the rays. The pulsating current, after amplification, is transmitted to the receiving machine, which consists of a disk containing a spiral of lenses exactly similar to the disk at the transmitting end, and revolving in synchronism with it. Behind this disk and in a position corresponding to that of the light-sensitive cell at the transmitting end, is a neon lamp, which is fed by the received current. The varying light from this lamp traverses a ground glass screen and reproduces there the object of transmission. Synchronism is obtained by driving the disk at the receiving end by means of a synchronous motor controlled by and in synchronism with a small a.c. generator coupled to the shaft of the propelling motor at the transmitting end.

**Electrical Trades Benevolent Institution.**—The annual general meeting was held at the Institution of Electrical Engineers on Monday last, Mr. W. B. Woodhouse, President I.E.E., being in the chair. Introducing the report and accounts, the chairman said the income for the year was £3,810, compared with £2,682 in 1923. Two of the local committees had been specially active in obtaining financial support. The dividends on investments were £1,064, compared with £984 in the previous year. The total expenditure amounted to £292, as compared with £241 in 1923. The amount of grants for temporary aid had increased from £474 in 1923 to £899, and the number given from 44 to 70. Both the total amount and the number of grants given were greatly in excess of any previous year, and assistance was given to every qualified person who applied. The amount carried forward to the balance-sheet was £2,620, compared with £1,967 in the previous year. The investments had during the year been increased by £2,101, bringing the total sum of the invested fund at cost to £23,833. The market value of this at the end of the year was £24,205.

The chairman remarked that this Institution and the Benevolent Fund of the I.E.E. kept closely in touch with one another so as to avoid overlapping. The I.E.E. Benevolent Fund existed to help members of the I.E.E., whilst this fund was for the purpose of assisting the large number of persons who were not qualified to be members of that Institution and others who, although qualified, had not become members. The chairman expressed his pleasure at the presence of ladies at the meeting, for the first time, and Mr. W. R. Rawlings, seconding the motion, pointed out that the whole of the management had been done at a cost of only £300, reflecting the greatest credit on the hon. secretary, Mr. F. B. O. Hawes.

The report and accounts were unanimously adopted, and the following retiring members of Committee were re-elected:—Messrs. R. W. Hughman, E. F. Johnson, Lt.-Col. H. M. Leaf, Messrs. P. A. Lundberg, F. H. Nalder, W. R. Rawlings, A. A. Campbell-Swinton, and L. G. Tate. In place of Mr. W. C. Mountain, who found it impossible to attend the meetings, Mr. J. A. Robertson, of Manchester, was elected.

Messrs. Price, Waterhouse & Co., the honorary auditors, were re-elected, and votes of thanks to them, to Messrs. Sugden, Hextall & Beal, the honorary solicitors, the Press, and the I.E.E. were recorded. A special vote of thanks to Mr. Hawes for his indefatigable labours was moved by Mr. Justus Eck, seconded by Capt. Wallis-Jones, and unanimously accorded.

**An All-Welded Ship.**—A vessel, constructed entirely by electric-arc welding, and practically devoid of rivets, has been launched at Providence, Rhode Island, and is declared to be the first all-welded craft made in the United States. It is a one-piece steel tanker barge, and is to be used for transporting oil; it was constructed with three sets of General Electric (of America) arc-welding equipment, one of which was used for tacking, with a fitting-up crew, and the other two for straight welding. Not more than six men were employed at any one time, whereas, according to the builders, 18 men would have been necessary had the barge been riveted, and it was further found that two electrically-welded barges could be built for the same labour cost as one riveted barge. The barge is 76 ft. long, 21 ft. wide, and 11 ft. deep; it carries two cylindrical oil tanks, each having a capacity of 26,000 gallons, and the total weight of the barge and tanks is 70 tons. A similar experiment was tried during the war in this country.

# Institution Notes.

**Institution of Electrical Engineers.**—Summer Meeting.—The I.E.E. summer meeting, referred to in our last issue, will be held at the invitation of the South Midland Centre Committee at that Centre. The programme provides for visits to the Princes Power Station, Nechells, and the Witton Works of the General Electric Co., Ltd., which will entertain the guests to lunch and tea, in the morning and afternoon respectively, of June 9th, and there will be a civic reception at the Council House by the Rt. Hon. the Lord Mayor of Birmingham, Alderman P. Bower, M.B.E., J.P., in the evening. For the second day, June 10th, visits have been arranged to the Longbridge Works of the Austin Motor Co., Ltd., and the rectifier sub-station of the City of Birmingham Electric Supply Department, Longbridge, in the morning and to the Shropshire, Worcestershire and Staffordshire Electric Power Co.'s power station in the afternoon, this company providing lunch and tea. In the evening, as guests of the Principal of the University of Birmingham, Mr. C. Grant Robertson, members will attend a reception and dance at the University, Bournbrook, Birmingham. Visits to the B.T.-H. Works, Rugby and Warwick, are on the programme for the third day; the B.T.-H. Co. will entertain the visitors to lunch and after a civic reception by the Mayor of Warwick, they will be entertained to tea on the lawn of Warwick Castle by the Leicestershire and Warwickshire Electric Power Co., the Midland Electric Light & Power Co., Ltd., and the Leamington and Warwick Electrical Co., Ltd. In the evening the General Electric Co., Ltd., will entertain the party with a gala night at Witton. The final day is provided for with visits to Stratford-on-Avon and Broadway, lunch at Evesham as the guests of the City of Birmingham Electric Supply Department, and a civic reception by the Mayor of Evesham in the morning, an afternoon on the river at Evesham, tea being provided by the City of Birmingham Electric Supply Department, and a gala night at the Botanical Gardens, Edgbaston.

It is suggested that during the evening of Monday, June 8th, the visitors should foregather at the Grand Hotel, Birmingham, where there will be a Registration and Information Office.

Wireless Telegraphy Bill.—The Council has addressed a letter to the Postmaster-General in which it is pointed out that in the Council's opinion some of the provisions of the Bill are of far-reaching importance, and unless modified will prove a hindrance not only to wireless telegraphy and radio science, but also to electrical and physical research and to the progress of electrical science generally.

The Council urges that it should be made clear that the words "any apparatus for wireless telegraphy" do not apply to such apparatus except in connection with wireless telegraphy, inasmuch as many pieces of apparatus such as condensers, crystal detectors, valves, &c., are now in common use in physical laboratories and by electricians generally for quite other purposes than wireless telegraphy.

The Council strongly recommends that all regulations made by the Postmaster-General under Clause 3 of the Bill should, before being placed before Parliament, be submitted to a statutory Advisory Technical Committee for consideration, such a Committee to be representative, *inter alia*, of the Royal Society, the Institution of Electrical Engineers, and the Radio Society of Great Britain.

Clause 7, which applies the provisions of the Bill to the use of etheric waves for the transmission of energy, might greatly interfere in directions quite outside its object, namely, to prevent interference with wireless telegraphy. It is suggested that for this clause a new one be substituted, rendering liable to penalties anyone using electromagnetic radiations of the radio frequencies commonly used in wireless telegraphy in such a way as injuriously to interfere with the working of authorised wireless telegraphic stations.

Informal Meetings.—At the meeting on March 23rd, Mr. L. J. Gooch was in the chair when Mr. R. Grierson opened a discussion on "Panel Heating." Mr. Grierson first considered the physiology of sensibility to temperature, showing the very considerable variation in loss of heat by the human body under conditions of rest and degrees of exertion. Using the analogy of the progress in electric lighting from brilliant and concentrated points of light to the large, less glaring, and more diffused methods of the newest illumination, he described a method of heating large surfaces and panels at comparatively low temperatures. These panels, which may be of any area, are quite shallow and are fitted flush with the surroundings so that they occupy no space and lodge no dust. Floors, ceilings, walls—mirrors, even—have been fitted with embedded wires, which do not get hot enough to affect paint or rubber in contact with the panel. Mr. Grierson claimed that the method was superior to the more generally known systems of heating in that in all cases where heating of air occurs, there is some elusive loss to the atmosphere which has become neither fresh nor yet devitalised, but yet is certainly changed. The system, which is the subject of numerous patents, is applicable to hot water and to vapour as well as to electricity. Nineteen speakers joined in the subsequent discussion.

Mersey and North Wales (Liverpool) Centre.—The annual general meeting of the Centre will be held on Monday, April 20th. The election of officers and four members of committee for the session 1925-1926 is the business of the meeting. The committee has made the following nominations:—Mr. A. E. Malpas, chairman; Mr. P. J. Robinson and Assoc. Prof. F. J. Teago, D.Sc., vice-chairmen; and Messrs. T. Cornfoot, R. G. Devey, H. Dickinson, P. M. Hogg, A. C. Livesay, W. M. Milnes, T. B. Morgan, and P. Priestley.

North-Western Centre.—The following have been nominated as candidates for the election of four members to fill vacancies on this Centre committee:—Messrs. J. Frith, T. E. Herbert, A. G. Livesay, A. Lund, A. B. Mallinson, and G. G. L. Preece.

Electricity in Chemical Industries.—Lecturing before the Irish Centre of the Institution in Dublin, on "The Use of Electricity in Chemical Industries in the Free State," Dr. J. F. Crowley, B.A., endorsed the view of the Department of Agriculture in the United States, that the direct synthetic ammonia scheme of nitrogen fixation offered greater promise of cheap nitrogen than any other existing process, and expressed his belief that it could be economically established in Ireland. Having traced the history of the electrochemical industry, he dealt with the fixation of atmospheric nitrogen for the manufacture of fertilisers and explosives. The conditions which governed the establishment of electrochemical industries were the cost of power, transport facilities, proximity of markets and of raw materials, and the availability and reliability of labour. Such industries provided in general a continuous load which was of the greatest value to the power engineer in enabling him to maintain low power costs. Indeed, the development of many hydro-electric schemes would not be justified on the basis of the general industrial load, although power users might be glad to take electricity. As one who had been a member of many official (British) committees which had considered the question of applying electricity to agriculture, he was of the opinion that electricity to the average Irish farmer must be regarded as an amenity, not as a necessity; and it was an amenity for which he might not be able to pay.

**Association of Consulting Engineers (Inc.).**—On Thursday last week the annual dinner of the Association was held at St. Stephen's Club, London. The Chairman of Committee, Mr. Sidney R. Lowcock, presided over a large attendance, including many distinguished guests. After the toast of "The King," Mr. A. H. Dykes (hon. secretary) proposed "His Majesty's Ministers," referring to the many functions of the Ministry of Transport—roads, traffic, and electricity supply. During a long journey in the Far East, from which he had recently returned, he had realised the crushing burden that was laid upon the shoulders of the Ministers. Lt.-Col. W. W. Ashley, M.P. (Minister of Transport), responded, expressing the indebtedness of his department to consulting engineers for help in solving the numerous engineering problems that arose. The congestion of traffic in Central London, which he was endeavouring with the aid of the Advisory Committee to relieve, must not be reproduced in the suburbs; by the construction of new roads and the improvement of existing ones the housing problem might be solved, as, given the assurance of transport facilities, houses would spring up 15 or 20 miles from the centre, and thus living conditions would be improved.

Proposing "The Association of Consulting Engineers," Sir John F. C. Snell (chairman of the Electricity Commission) remarked that if the Commissioners yielded to the demands made upon them they would be consulting engineers to the whole country—without fees; however, they referred inquirers to members of the Association, whose high standard of professional etiquette he recognised. Engineers afforded valuable help to courts of law and Parliamentary committees, but he had noticed a tendency to challenge the fees of consulting engineers, who had office expenses, &c., in view of the lower fees of municipal expert witnesses, and he suggested that the Association should take up this point with the Bar. As a founder of the Association, he was glad to see its growing influence; it owed an enormous debt to Mr. A. H. Dykes, as well as to the hon. solicitor and its chairmen. Responding, Mr. Lowcock remarked that to Mr. Dykes was due the formation of the Association some 15 years ago, and recognised the valuable services of the hon. solicitor, Mr. F. E. Wright, and hon. auditor, Mr. W. Cash.

Mr. G. Midgley Taylor proposed "The Bench and Bar," and the toast was acknowledged by Mr. T. R. Hughes, K.C. (chairman of the Bar Council), and Sir Lynden Macassey, K.B.E., K.C. Mr. A. M. Sillar proposed "The Guests," alluding to Sir Chas. Parsons as one who had done more to advance the progress of mechanical engineering than any other engineer of this generation. Sir George Hume, M.P., responded, remarking that the problems put to the Advisory Committee were very difficult, but the Committee was extraordinarily active—and it had need to be.

**Diesel Engine Users' Association.**—At the meeting to be held on Friday, April 17th, at the Engineers' Club, London, a paper by Mr. J. L. Chaloner on "Recent Oil Engine Developments" is to be read and discussed. Non-members desirous of attending the meeting should apply for tickets to Mr. Percy Still, joint honorary secretary.

# Our Personal Column.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*

At its meeting on Wednesday, the Manchester City Council had before it a recommendation from its Electricity Committee, that Mr. S. L. Pearce, the chief engineer and manager of the electricity department, be permitted to assist the Electricity Commissioners in the preparation of a national electricity supply scheme. It was stated by the Committee that the Government was seriously considering the question and a conference had been formed to consider additional legislation and other matters. Lord Weir presides over the conference and Messrs. S. L. Pearce, C. H. Merz, and J. McF. Kennedy have been requested by the Government to act as a Special Technical Advisory Committee to assist Sir John Snell and the Electricity Commissioners in the preparation of the scheme. A Manchester paper says that they are to "assist the Commissioners in the work of reviewing, checking and, if necessary, amending a national scheme of electricity development." The same paper, in referring to a letter addressed to the Committee by Sir John Snell asking for Mr. Pearce's assistance,

[Lafayette] [Manchester.

**Mr. S. L. Pearce, C.B.E., M.I.E.E., &c.**

says that Sir John had previously intimated to the Government, through the Ministry of Transport, the desirability of the scheme prepared by the Commissioners being checked by three experts.

*The Electric Railway and Tramway Journal* states that by 25 votes to 19 the Belfast Corporation recently rejected the General Purposes Committee's recommendation to terminate the agreement with the present Manager of the Tramways Department and to offer him an appointment under the new manager, "in view of the magnitude of the Corporation's tramways undertaking, the large amount of capital involved, and the necessity for a re-organisation of the system in order to provide the most beneficial service for the public at the lowest rates compatible with efficiency." The committee's contention was that the present manager did not possess the engineering qualifications or administrative experience that were necessary under the new scheme. The Council was satisfied that the manager was carrying out his duties effectively, last year's working having shown a considerable credit balance. The matter was mentioned in the Electrical Review for September 19th, 1924 (p. 441).

The marriage took place at Teddington, on March 14th, of Mr. William Millner, A.M.I.E.E., and Mrs. Una Mary Simms, widow of Mr. Eric Dinmore Simms.

Maidstone Town Council has been recommended to increase the salary of the Tramways Manager from £600 to £650 per annum.

The Leeds Corporation Tramways Committee selected three from among 35 applicants for the position of tramway and transport general manager, and these appeared before it on Monday last. The systems for which they are at present responsible are to be visited by members of the committee.

Mr. W. G. Marks, traffic superintendent and chief clerk to the Rotherham Corporation Tramways Department, was on March 27th appointed tramways manager at Chesterfield, in succession to Mr. G. H. Margrave, who has lately become manager to the West Riding Motor Company.

The *Yorkshire Observer* states that Mr. J. F. Bowman, superintendent of the Scarborough General Post Office Telegraph Department, was presented with an oak sideboard on his retirement after 45 years' service.

Mr. R. B. Mitchell, electrical engineer to Glasgow Corporation, has been nominated as one of the vice-presidents of the Institution of Engineers and Shipbuilders in Scotland.

Electrical enterprise, in the person of Mr. Samuel Insull, of Chicago, has received a tribute of honour. On March 24th, Mr. Insull was entertained to dinner at the House of Commons by the Rt. Hon. T. P. O'Connor, M.P. He received from Lord Birkenhead, who proposed the toast of the guest, eulogy and commendation, and presumably, from the assembled members of both Houses, a complimentary ovation. All of this we feel was extremely fitting. Mr. Insull stands amongst the foremost figures of electrical enterprise, whether in his own country or the rest of the world. He has done a splendid achievement in showing the proper scale on which to organise electricity supply. So the tribute paid by the Members of the Commons, and the noble Lords, whilst rightly directed to Mr. Insull, has also a reflective value on the industry generally.

We give, accompanying these lines, a photograph of Lt.-Col. F. A. Cortez-Leigh, M.Inst.C.E., M.I.Mech.E., &c., electrical

**Lt.-Col. F. A. Cortez-Leigh, M.Inst.C.E., M.I.E.E.**

engineer of the London, Midland and Scottish Railway, who, as announced in our issue of March 20th, p. 466, is in charge of the electrical department of that railway company.

Mr. H. Waring, until recently constructional engineer and clerk of works to the Northampton Electric Light & Power Co., Ltd., has been engaged by the Colchester Corporation to supervise the erection of the Corporation's new e.h.t. power station at the Hythe, Colchester.

A clock and a purse of Treasury notes were presented to Mr. George Rennison, ex-foreman of the Harrogate Corporation Electricity Department, on the occasion of his retirement and his golden wedding.

**Obituary.**—Mr. E. H. Crapper.—We regret to learn of the death, which occurred recently at Rhos-on-Sea, of Mr. Ellis Herbert Crapper, who, on the establishment of Sheffield University was appointed head of the Electrical Engineering Department, which position he retained up to his death. He was 64 years old. As our readers are aware, Mr. Crapper was the author of a number of text-books on electrical subjects.

Mr. E. R. Harding.—The death occurred on March 21st, at the age of 48 years, of Mr. Ernest Raymond Harding, director of Harding Bros., Ltd., Hereford, and manager of the firm's electrical engineering department. He was a son of the founder of the firm, the late Mr. Richard Maurice Harding.

Mr. R. Scott.—The death occurred suddenly, on March 21st, at the age of 60 years, of Mr. Robert Scott, who was for 14 years chief electrician at Thorne Colliery, near Doncaster.

Mr. T. J. Reynolds.—We regret to record the death of Mr. Thomas Joseph Reynolds, construction superintendent of the turbine department of the British Thomson-Houston Co., Ltd., at Rugby, aged 49. He was staying at Arnside to recuperate after illness due to overwork. The jury returned an open verdict of "Found Drowned."

**Will.**—The late Mr. C. H. Wordingham left £7,779 net personalty and £10,906 gross.

# New Companies Registered.

**Charles Fitzhugh, Ltd.** (204,753).—Private company. Registered March 25th. Capital, £500 in £1 shares. To carry on the business of distributors and factors of, and dealers in Bosch dynamos, magnetos, electric horns, electric lighting sets, electric starters, and all Bosch apparatus, inventions, and accessories in connection with motor-cars, lorries, commercial vehicles, and motor-cycles, &c. The first directors are:—C. Fitz-Hugh, 14, Ladypool Road, Sparkbrook, Birmingham, engineer; Mrs. F. Fitz-Hugh, Ladypool Road, Sparkbrook, Birmingham. Qualification, 1 share. Solicitor: J. Passey, 71, Temple Row, Birmingham.

**Astra Dynamo, Ltd.** (204,826).—Private company. Registered March 27th. Capital, £5,000 in £1 shares. Objects:—To adopt an agreement with the Astra Dynamo Co., to acquire the business of engineers and manufacturers of, and dealers in motor-cycle accessories carried on by that company at 124, Victoria Street, S.W., together with the trade mark, "Astra"; and to carry on the said business and that of dealers in wireless or other scientific apparatus or accessories, sports requisites, electric or other signs or illuminants, &c. The first directors are:—C. T. Freeman, 128, Alderman's Hill, Palmer's Green, N.13, engineer; F. U. Y. Weldon, 94, Alderman's Hill, Palmer's Green, N.13, engineer. Qualification, £50. Remuneration, 25 per cent. of the net profits divided between them. Solicitors: Garton & Co., 21, Maddox Street, W.1.

**Coventry Electrical Accessories, Ltd.** (204,735).—Private company. Registered March 24th. Capital, £1,000 in £1 shares. To carry on the business of factors, manufacturers, licensors and licensees of electrical materials, appliances, tools and apparatus of all kinds, including electrical apparatus for all purposes for which electrical energy and phenomena can be applied, &c. The governing directors are:—J. Jackson, 69, St. Michael's Road, Coventry, merchant; H. B. Jackson, Broadlands, Kenilworth Road, Coventry, merchant. Secretary and solicitor: F. A. Bulloch, 35, Bayley Lane, Coventry. Registered office: Conduit Yard, Fleet Street, Coventry.

**Gold Bow Enamel Wire Co., Ltd.** (204,762). — Private company. Registered March 25th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of insulated, electrical and other wires, &c. The subscribers (each with one share) are:—F. H. Oakley, Chepstow Lodge, Shepperton, clerk; A. R. Rossiter, "Kewstoke," Claygate, Surrey, shirt manufacturer. The first directors are not named. Solicitors: Gordon Gardiner, Carpenter & Co., 7, Serjeant's Inn, E.C.4.

**Dunstable Central Motor and Electrical Co., Ltd.** (204,759).—Private company. Registered March 25th. Capital, £2,000 in £1 shares. To carry on the business of motor, cycle and general engineers, motor body builders and repairers, electricians' salesmen or agents, manufacturers of wireless and electrical goods, instruments, electrical wiring engineers, &c. The first directors are:—H. Eames, 4, West Street, Dunstable; J. E. McCabe, 8, Byward Street, E.C. In the event of J. E. McCabe desiring to retire he may nominate his successor. Qualification, £1. Remuneration as fixed by the company. Solicitor: A. G. E. Machin & Co., Luton. Registered office: 4, West Street, Dunstable, Beds.

**Radio Press Service Department, Ltd.** (204,773).—Private company. Registered March 25th. Capital, £100 in £1 shares. To carry on the business of consultant and electrical engineers, and expert advisers in radio telegraphy and telephony, submarine signalling and/or any other means of radio communication, conductors of technical editorial service, proprietors and publishers of books, journals, magazines, newspapers and other literary work, &c. The first directors are:—J. Scott-Taggart, F.Inst.P., A.M.I.E.E. (sole governing director and chairman), 6, Beattyville Gardens, Ilford, Essex; Dorothy Scott-Taggart, 6, Beattyville Gardens, Ilford, Essex (both directors of Duncan Scott, Ltd., and Barclay's Advertising, Ltd.). Qualification, 1 share. Remuneration as fixed by the company. Solicitors: Ravenscroft, Woodward & Co., 15, John Street, Bedford Row, W.C.1. Registered office: Bush House, Kingsway, W.C.2.

**Radio Accessories, Ltd.** (204,739). — Private company. Registered March 24th. Capital, £30,000 in £1 shares. Objects: To manufacture, assemble, erect, install, maintain, repair and deal in wireless, telegraphic and telephonic apparatus, valves, instruments, equipment, accessories, electrical, magnetic and radioactive instruments and apparatus, &c. The subscribers (each with one share) are:—W. R. Smith, 6, Lawley Street, Clapton, E.5, clerk; E. J. Burrows, 28, Lyndhurst Road, Highams Park, Chingford, E.4, clerk. The first directors are to be appointed by the subscribers. Qualification, £1. Solicitors: Herbert Smith, Goss, King and Gregory, 62, London Wall, E.C.2.

**Radiocoil Electro-Magnetic Blanket, Ltd.** (204,740).—Private company. Registered March 24th. Capital, £2,000 in £1 shares. To acquire and carry on any scientific, therapeutic, medical or surgical institution which carries on business for profit; to acquire any inventions relating to heating or lighting by electricity for hygienic, therapeutic or general purposes; and to carry on business as electrical engineers, manufacturers of and dealers in surgical, medical and dental goods, &c. The first directors are:—W. E. Holder, 18, Milton Road, Highgate, N., electro-therapeutic practitioner; J. M. Watts, 55, Fitzroy Road, Regent's Park, N.W.1, gentleman; H. W. Hammant, address not stated; J. G. Stephens, address not stated. No qualification required. Secretary: N. E. Mathieson, 4, Leghorn Road, London.

**Larmuth & Bulmer, Ltd.** (204,768). — Registered as a "public" company on March 25th, with a nominal capital of £200,000 in £1 shares (80,000 7 per cent. cumulative preference and 120,000 ordinary). The objects are:—To acquire and amalgamate the businesses of manufacturers of machinery for producing hemp and wire ropes and electric cables, engineers, mechanics and ironfounders carried on (1) by Thomas Larmuth & Co., Ltd., at Todleben Ironworks, Salford; (2) by F. C. Bulmer, S. Bulmer and A. E. Bulmer at the Spring Garden Engineering Works, Newcastle-upon-Tyne, as "John Bulmer & Sons"; and (3) by the said F. C. Bulmer, S. Bulmer and A. E. Bulmer at Brook Buildings, Cleckheaton, as "Harding & Harding," and to adopt agreements (1) with Thomas Larmuth & Co., Ltd., J. H. Larmuth and others, and (2) and (3) with F. C. Bulmer, S. Bulmer and A. E. Bulmer. Minimum cash subscription, 7 shares. The first directors are:—J. H. Larmuth, Hill Crest, Upper Colwyn Bay (director of Thomas Larmuth & Co., Ltd.); W. O. Larmuth, M.I.Mech.E., "Hillbre," Alpraham, near Tarporley, Ches. (director of Thomas Larmuth & Co., Ltd.); J. A. Larmuth, Light Oaks Road, Pendleton, Manchester (director of Thomas Larmuth & Co., Ltd.); F. C. Bulmer, Wingrove Road, Newcastle-upon-Tyne, engineer; S. Bulmer, Ashlyn, Moorside, Newcastle-upon-Tyne, engineer; A. E. Bulmer, 6outh Bank, Otterburn Villas, Newcastle-upon-Tyne, engineer. Qualification, £250 shares or stock. Remuneration (except managing director), £3,000 per annum divided between them. Solicitors: Addleshaw, Sons & Latham, 15, Norfolk Street, Manchester, and Maughan and Hall, Newcastle-on-Tyne. The registered office is at Todleben Iron Works, Union Street, Cross Lane, Salford.

**"Sunstar" Radiant Treatment Co., Ltd.** (204,798).—Private company. Registered March 20th. Capital, £800 in £1 shares. To acquire the rights of T. C. Angus in an invention relating to small electric arc lamps (provisional specification No. 24,674, dated October 17th, 1924), to acquire and turn to account any inventions relating to non-automatic arc lamps for remedial treatment by means of light rays, &c. The directors are:—T. C. Angus, "Pitreavie," Carroll Hill, Loughton, research worker; G. W. C. Webb, 99, St. Paul's Road, N.1, engineer. T. C. Angus is permanent, subject to holding 250 shares. Remuneration, 5 per cent. of the net profits each. Secretary: G. W. C. Webb. Registered office: 99, St. Paul's Road, N.1.

**J. B. Manufacturing Co., Ltd.** (204,712).—Private company. Registered March 23rd. Capital, £500 in 400 8 per cent. cumulative preference shares of £1 and 2,000 ordinary shares of 1s. each. To acquire and turn to account any invention relating to electrical and other advertising signs and devices, &c. The directors are:—R. R. Balding, Marlboro' Arms, Walwood Street, Camberwell, S.E.5; S. Jones, 90, High Holborn, W.C., engineer. Remuneration as fixed by the company. Secretary: S. Jones. Registered office: 83, Avenue Chambers, Southampton Row, W.C.

**The Radio Company of Great Britain, Ltd.**—This company was incorporated on February 13th last, with a nominal capital of £100 in £1 shares, to carry on business as electricians, &c. Brief particulars were duly published in our columns, but no names of directors were given in the original documents, and no notice of situation of registered office was filed. Additional documents have now been filed, showing that the registered office is at 7, Moorgate, E.C., the secretaries are Messrs. Close Brothers, Ltd., and the directors are:—Geo. C. H. Hamilton, Kingsmead, Claygate, Surrey, director of Close Brothers, Ltd.; Robert Sweeny (a citizen of the U.S.A.), 58, Jermyn Street, S.W.1, director of Federated Securities Corporation; H. l'Anson Jones, Dunolly, Gerrards-Gross, Bucks., director of Close Brothers, Ltd.; Henry W. Pelham-Clinton, 4, Green Street, Park Lane, W.1, director of Zinc Corporation, Ltd. A series of debentures for £240,000 has also been created and issued, and the filed particulars of this series mention certain arrangements between this company and Burndept, Ltd., and Burndept Wireless, Ltd. Details will be found in "Official Returns of Electrical Companies."

# Official Returns of Electrical Companies.

**Radio Company of Great Britain, Ltd.**—Particulars filed of £240,000 debentures authorised March 20th, 1925, charged on the undertaking and assets of the business of Burndept, Ltd., acquired by the company under an agreement dated March 11th, 1925, and the benefit of the agreement between the company and Burndept Wireless, Ltd., for the sale of the same and the consideration receivable therefor. The whole amount is now issued.

**Seaton and District Electric Light Co., Ltd.**—Debenture dated March 14th, 1925, to secure £1,000 charged on freehold and other property, assets, and undertaking charged by debenture dated June 30th, 1924, for £5,000. Holder: Solicitor to H.M. Treasury.

**Orford Electric Light and Power Co., Ltd.** — Issue on March 4th, 1925, of £100 debentures, part of a series already registered.

**Bullers, Ltd.** (62,020).—Return dated January 5th, 1925. Capital, £400,000 in 20,000 ordinary and 20,000 preference shares of £10 each. 15,593 ordinary and 15,000 preference shares taken up. £150,070 paid on 7 ordinary and 15,000 preference shares. £155,860 considered as paid on 15,586 ordinary shares. Mortgages and charges, £229,750.

**Adelaide Electric Supply Co., Ltd.** (84,209).—Return dated December 8th, 1924. Capital, £2,000,000 in 500,000 ordinary, 1,250,000 preference, and 250,000 preferred ordinary shares of £1 each. All shares taken up. £1 per share called up on 370,000 ordinary, 1,000,000 preference, and 250,000 preferred ordinary shares, and 10s. per share on 250,000 preference shares. £130,000 considered as paid on 130,000 ordinary shares. Mortgages and charges, £836,882.

**Huntalite, Ltd.** (81,387). — Return dated January 27th, 1925. Capital, £2,000 in £1 shares. 1,800 shares taken up. £1,500 paid. £300 considered as paid. Mortgages and charges, nil.

# City Notes.

**British Aluminium Co., Ltd.**

The annual meeting was held on March 27th at Winchester House, E.C. Lieut.-Col. J. H. Pollen, C.M.G., who presided, first referred to the resignation of the late chairman, Mr. Tait, of his seat on the board consequent upon a judgment delivered in the Chancery Court on February 12th in a case to which Mr. Tait was not a party, and from which, therefore, he had no appeal. He said that of course it was not for him (Mr. Pollen) to question the Judge's statement of the law, but when they considered the motives which actuated Mr. Tait in what he did, they were entitled to form their own judgment on the evidence available and on their knowledge of the man himself. Mr. Tait had given the board his version of the case and of the reasons underlying his actions, and the directors were unanimous in thinking that, whatever technical error he might have been led into, he was prompted by no unworthy motive, but rather by a desire to secure the success of a scheme of reorganisation which had since received judicial sanction and was in course of being carried into effect. The speaker went on to refer to the remarkable progress of the company since, 15 years ago, Mr. Tait became chairman at a critical moment in its history. Turning to the report, the chairman said that the net profit for the year amounted to £491,973, against £362,704 for the previous year. The trading profit was £476,709, an increase of £136,063, which reflected satisfactorily the improved conditions operating in the industry during the year. The demand for their metal noted in the report a year ago continued throughout the year with no signs of slackening, and the more favourable basis of prices was maintained. During the earlier part of last year they experienced an abnormally low rainfall at their hydro-electric installations in Scotland and Norway, which resulted in their having a lower margin of water storage with which to meet requirements during the late spring and early summer months. That state of affairs led to the necessity of some reduction in output, and, in consequence, they had a little difficulty for a short period in adequately fulfilling their obligations to customers with the promptitude which was their invariable aim. Later in the year the situation returned to normal. Apart from that cur-

cumstance all their works operated at full capacity throughout the year. The cost of production during the year had shown an increase, due to the somewhat lower production and to the increase in the cost of several of the essential raw materials. The consumption of aluminium in the industries which chiefly absorbed the metal, continued to expand in this and other countries. Many new avenues for the utilisation of the metal opened up as time went on, and the broadening field was encouraging for the future. Alloys of the metal had made further progress, but in that direction there still remained much to be achieved. In that connection he would like to take the opportunity of emphasising the need and the value of intensive research work. That company had consistently pursued, as far as circumstances permitted, a policy of research which had been productive of good results and held out much promise for the future, but he desired to pay tribute to the work of independent investigators in this field. The work of those investigators had been of real service to the producer, to the worker, and to the user of the metal, and they welcomed these valuable contributions to their knowledge. It was appropriate to mention the potential value of co-operative research opened to the industry generally through the medium of the British Non-Ferrous Metals Research Association. Last year he reported the situation, as it then existed, as to the Lochaber water power scheme promoted by the company. Later in the year it was found that the carrying out of the works would involve a rather greater expenditure than had originally been contemplated. Before proceeding, therefore, the financial programme was reconsidered and, following renewed negotiations with the Trade Facilities Act Advisory Committee, that Committee recommended the Treasury to extend the Government guarantee to a loan of £2,500,000 in place of the previously-agreed loan of £2,000,000. In addition, the currency of the loan was extended from 25 to 30 years, with the sinking fund operating over a period of 25 years, to commence five years after the issue of the loan. Those additional facilities made it possible for the company to proceed with the scheme, and the main contract for the civil engineering works had recently been placed and work had been commenced. A subsidiary company—the North British Aluminium Co., Ltd.—had been set up to carry out the works, and the Government-guaranteed loan issue of £2,500,000 was made in February. The construction of the Lochaber works would absorb a large labour force and would be prosecuted with all speed, but a considerable time must elapse before they reached the producing stage. In the balance-sheet stocks of metal, raw material, and stores stood at £202,388, against £244,708, a reduction of £42,320. As to the future, it was impossible to predict what lay in front of them, but given a continuance of conditions as they existed to-day, the directors ought to be in a position to lay at least an equally satisfactory account before the shareholders when they met next year.

**Newcastle-upon-Tyne Electric Supply Co., Ltd.**

This company's report was dealt with in our issue of March 20th (p. 468). The annual meeting was held on March 24th, and in the course of his speech the chairman (Mr. R. P. Sloan, C.B.E.) said that the depression in industry continued, and in that respect the past year was disappointing. Moreover, there had also been a slump in the coal trade owing to foreign competition. Nevertheless, the company's profit had increased by £40,700, and this had enabled the company to pay a larger dividend and to transfer more to the reserves. During the year connections representing 29,682 h.p. had been made, bringing the aggregate up to nearly 600,000 h.p. Altogether about £300,000 had been expended during the year upon the maintenance and improvement of the undertaking. The investments in and advances to associated companies increased by £375,423 during the year. The total investment in the Tees Power Station Co., Ltd., was £912,978, a further sum of £336,381 having been invested in shares of that company during 1924 to provide funds towards generating station extensions. It was hoped that the first section of the new plant at the Tees station would be ready for operation towards the end of the current year. A further sum of £110,000 had been invested in the County of Durham Electrical Power Distribution Co. to enable that company to meet expenditure upon new distribution lines and general extensions. £16,307 had been invested in the company which was erecting the new office buildings, which were referred to at the last meeting.

Leaving the accounts, the chairman said that it was very difficult to make an accurate forecast of the future. There was no evidence of improvement in the shipbuilding and engineering trades or in the North-East Coast coal trade. The steady increase in the company's business was largely due to the growth of new connections, which had compensated for lower demands from existing consumers. The growth in the domestic demand was very rapid. The number of new consumers connected in 1923 was nearly double the number in 1922, while during the past year the increase in the number of new consumers connected represented 165 per cent. increase over the previous year's figure. Two years ago the connected heating and cooking load was 16,000 h.p.; at the end of last year the total exceeded 25,000 h.p. Apart from ordinary extensions to existing networks, eight new networks in county districts had been added during the year, and were becoming revenue earning. A considerable number of municipal housing schemes had also been dealt with, and over 600 houses had already been connected up. One of the schemes involved the equipment of 200 houses with electric heating, cooking, and lighting installations. The rapid progress in this branch of the business was mainly due to the growing appreciation of the benefits of electricity. A special "residential" tariff had been framed to enable a substantial reduction in price to be given to consumers who wished to avail themselves of domestic electrical devices. Further efforts were being made to develop this important section.

The report and accounts were adopted.

**British L.M. Ericsson Manufacturing Co., Ltd.**

The report of this company was reviewed in our last issue (p. 506), and in moving its adoption at the annual meeting on March 26th, the chairman (Mr. W. M. Crowe) said that the amounts written off for depreciation and obsolescence, as well as the fund provided out of revenue for the upkeep of plant, made the value of the assets much more than the figures in the balance-sheet indicated. Apart from this no value was placed on goodwill, patents, &c., which, for a company such as that, were very valuable. The extensions to the works which had had to be made were provided for by a loan on favourable terms. That loan had already been reduced, and would soon be paid off. The wireless department had developed very satisfactorily, although the demand had slackened since the end of last year. The number of radio sets per 1,000 inhabitants in this country, however, was still below the figure which obtained in the United States and Canada. If the British Broadcasting Co. kept up and improved the quality of its service, the demand for receiving sets would continue to grow.

In telephonic development also we were far behind other countries, but steps were being taken to remedy this state of affairs. It was calculated that to put this country on an equal basis with such a small state as Denmark it would be necessary to spend £150,000,000 and install 3,000,000 telephone stations, while to reach the pitch of development in the United States or Canada would require that sum and the number of stations to be multiplied many times.

The Telephone Development Association, of which the company was a member, was working in conjunction with the Post Office in the education of the public to the benefits of the telephone. The prospects for the industry were bright, and the company should benefit, as well as others connected in various ways with the industry. The automatic telephone system was assuming important dimensions, and the company was building up a department to deal with it. They had made many preparations for the big demand which was anticipated. A new power station had been built, which should provide sufficient power for many years to come, and the works had been considerably extended.

**City of London Electric Lighting Co., Ltd.**

The annual meeting of the company was held on March 25th under the chairmanship of Mr. J. B. Braithwaite. In presenting the report and accounts (*vide* our last issue), Mr. Braithwaite said that in spite of further reductions in charges to consumers, the net revenue had increased by over £40,000. That enabled the company to pay the same dividend (15 per cent.) and to increase the amount carried forward. There had been complaints that the company's dividends were exorbitant, but spread over the life of the company they only averaged 7 per cent. So far as they could judge, the outlook for the current year was of a satisfactory nature, but much depended upon the passing of the London Electricity Supply (No. 1) Bill.

The report and accounts were adopted, and the chairman then outlined the provisions of the above-mentioned Bill, and moved a resolution approving the two agreements scheduled to it and empowering the directors to take such steps as were necessary to protect the company's interests. The first agreement was that negotiated between the companies and the London County Council, while the other was an agreement with the County of London, the South Metropolitan, and South London Companies for centralisation of their generating resources. The resolution was carried.

**Midland Electric Corporation for Power Distribution, Ltd.**

The annual meeting of this company, whose report was reviewed in our issue of March 20th (p. 468), was held on March 23rd. In the course of his speech the chairman (Mr. James Taylor) said that the accounts again showed progress and the total distribution of 15 per cent. compared with 12½ per cent. in the previous year. Larger contributions had been made to the depreciation and reserve accounts, but the carry-forward was less. During the year £94,446 had been spent on new plant and mains extensions, but further extensions were necessary and an expenditure of £37,000 had been sanctioned for the provision of a new 5,000-kW generating set, cooling towers, &c., and £30,000 for e.h.p. mains. In spite of bad trade in the district the sales had risen from 42 to 48 million kWh, and the net profit from £126,000 to £130,000. The general principle of the scheme for the formation of a Joint Electricity Authority for the West Midlands area had been agreed upon by the parties concerned, but the scheme had not yet been passed by the Electricity Commissioners. The company's station alone would pass into the hands of the authority; the company would retain its distributing system and the shareholders' interests would not be affected.

**Mersey Power Co.**

At the 36th annual meeting of the shareholders of the Salt Union, Ltd., held at Liverpool last week, Mr. G. H. Cox, J.P., the chairman, referred to the activities of the Mersey Power Co., a subsidiary company. It was not yet in a position, he said, to deliver current to the Crewe works of the L.M. & S. Railway Co., owing to delays that had occurred in the laying of the cables, a matter over which the company had no control. The amount of energy sold in 1924 was 39,608,081 kWh, as compared with 30,761,642 kWh in 1923. The North Wales Power Co. had intimated that it would require at once 3,500 kW, when the cable to Crewe was finished and that the town of Northwich would take from the same cable 500 to 1,000 kW. The Wirral Council had also undertaken to buy a minimum of 500 kW. It had become necessary to extend the Percival Lane station by the addition of several new boilers and a turbo-generator, and the estimated cost of the additions would be £200,000.

**A. Reyrolle and Co., Ltd.**

The directors' report for 1924 shows that the profit, after providing for depreciation, redemption of leases, &c., was £66,200 (as against £63,239 in 1923). To this is added £17,009 brought forward, and £500 distributed among local charities is deducted, making £82,709 (£79,808). The preference dividend absorbs £2,800; a 12½ per cent. dividend (5s. already paid) is recommended on the ordinary shares; and it is proposed to transfer £25,000 to reserve and to carry forward a balance of £19,706. During the year a total of £91,837 was spent on capital account. The new machine shops were finished early in the year and the output was then considerably increased. The greater part of the cash resources in hand at the end of 1923, in the form of investments, loans, and bank deposits, has been applied to meeting this expenditure and dealing with the increasing turnover of work. The company has erected some dwelling houses for the employés and £2,000 has been provided out of the year's profits towards the cost of laying out a recreation ground. The balance of the authorised capital (80,000 £1 ordinary shares) was offered to shareholders at 25s. per share in November last and was immediately over-subscribed. This issue raised the capital of the company to £400,000.

**Electric Supply Corporation, Ltd.**

The annual meeting was held on March 26th, under the chairmanship of Mr. J. G. B. Stone, who, in moving the adoption of the report and accounts (which were reviewed in our last issue, p. 506), said that although the average increase in connections was only 7 per cent., the general increase was much higher, the average being affected by the small increase of 2 per cent. at Dumbarton. On the other hand, the additional power supplied at Dumbarton represented an increase of 27 per cent., as compared with a general average of 10 per cent. In Dalkeith, owing to the connecting up of a carpet factory, the connections had increased by 35 per cent. The gross earnings generally had risen by 11 per cent., and the profit, including dividends from investments, was 16 per cent. better.

They were arriving at a time when several of their undertakings might be purchased by the local authorities concerned. The question of price was a difficult one upon which to make any statement, but he would say that the London companies were to be purchased by the London authorities at their value at the time of purchase, but they had entered into a new arrangement. At present the Corporation's undertakings could only be bought out as going concerns with a payment for goodwill.

The Dumbarton tramways, in which they were interested, had been doing badly, and the Corporation had invested £7,500 from its reserve funds in the form of short-term notes issued by the tramway company for the purpose of providing motor-'buses to assist the company to recover its position.

**Brompton and Kensington Electricity Supply Co., Ltd.**

In presenting the report and accounts (Electrical Review, March 20th, p. 467) at the annual meeting on March 26th, the chairman (Mr. H. R. Beeton) stated that the business had shown a satisfactory growth. In production capacity the normal rating of the company's turbo-alternators, with their complement of oil-fired boilers and cooling towers, was nearly 50 per cent. greater than a year previously, and the distribution system was capable of dealing with the demands of the district for many years to come. Although the increase in the number of consumers had not been so great as in 1923, the connected load had grown at a more rapid rate. The financial result had not been commensurate with the growth of the business, partly because of reductions in the charges to consumers, but also because of the higher cost of fuel, the provision of funds for income tax, and larger allocations to depreciation and reserve. Speaking of the proposed reorganisation of electricity supply in London, the chairman said that it was impossible to convey a precise estimate of the dividends which would accrue to the shareholders, but their interests would be safeguarded to the best of the directors' ability. The report and accounts were adopted, and subsequently a resolution was approved giving the directors power to take any necessary steps for the protection of the shareholders' interests under the reorganisation schemes.

**South London Electric Supply Corporation Ltd.**

The annual meeting was held on March 26th, when Lt.-Col. Sir Frederick Hall, Bart., presided in the absence of Sir Harry Renwick. In presenting the report (*vide* our last issue, p. 505) the chairman said that the results of the past year had been even better than those of 1923; there was an improvement in every respect. The total reserves, including the amount carried forward, amounted at the end of the year to £305,948, while the company's issued and fully-paid capital was £260,000. The connections had increased by 1,252 kW, and the amount of energy sold by 1,642,369 kWh. After reviewing the provisions of the London Electricity Supply (No. 1) Bill, in the promotion of which the company is participating, the chairman said that the prospects for the current year were satisfactory in every way, particularly in view of the Bill which would lead to closer co-operation between the companies and further economies in production.

**Waste Heat and Gas Electrical Generating Stations, Ltd.**

The annual meeting of the Waste Heat and Gas Electrical Generating Stations, Ltd., was held in Newcastle-on-Tyne on March 25th. Mr. F. S. Newall, the chairman, presided, and in moving the adoption of the report, said that the capital expenditure during the year had been £27,651, which was spent entirely on the extensions to Horden Power Station. There would be a further expenditure of approximately £12,000 upon the station.

The profits for the year showed an increase of £1,132, which was accounted for by the small increased aggregate output of the stations, and additional revenue in respect of the extensions to the Horden station. The Ayresome power station was shut down last September owing to the closing down of the blast furnaces, but the station was restarted in January this year. The outputs of some of the other stations were considerably reduced owing to blast furnaces and coke ovens not being in full commission. On the other hand, the Teesbridge and Clarence stations exceeded the previous year's output, and as the Horden extensions were started up towards the end of the year, the net aggregate output showed an increase of 5 per cent. The result was satisfactory if they considered the very severe depression in trade in the district.

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**Metropolitan-Vickers Electrical Co., Ltd.**—The report for the year ended December, 1924 (to be submitted at the annual meeting on April 7th) shows a balance on profit and loss account of £178,808, plus £85,517 brought forward. £25,000 is to be put to general reserve; dividends of 8 per cent. per annum on the preference and ordinary shares absorb £146,940, and £92,385 is to be carried forward. It is stated that orders received during 1924 showed an improvement over those for 1923, while shipments from the works also showed an increase. Prices, however, remain at a low level owing to continued severe competition. The company secured in 1924 several important contracts, the execution of which will provide work during the current year. With the increasing importance of the department dealing in Cosmos lamps and electrical accessories, in the interests of efficiency these have been placed on an independent basis through the new company, Metro-Vick Supplies, Ltd., the whole of the capital in which is held by this company.

**Arbroath Electric Light and Power Co., Ltd.**—The report for the past year shows that the profits amounted to £5,814, plus £1,288 brought in, making £7,102. After deducting interest charges and preference dividend a balance of £6,740 remains. This is allocated as follows:—To reserve and renewals fund, £2,500 (making it £22,500); dividend of 8 per cent., less tax, on ordinary shares; additional dividend of 1 per cent., less tax, on preference shares, making the total dividend 6 per cent. for the year; £1,609 carried forward. The directors state that the extensions to the generating plant were satisfactorily completed, and the business of the company continued to develop, notwithstanding the depressed condition of many trades.

**British Electric Transformer Co., Ltd.**—The report for 1924 records a net profit of £35,174. It is proposed to transfer £10,000 to the reserve account and £5,000 to depreciation reserve; to pay the preference dividend (7 per cent.) for the half year to June 30th, 1923; and to carry forward a balance of £9,674. The directors state that the business has shown steady improvement during the year, and the profit earned compares favourably with a loss of £22,129 in the preceding year, to which was added £4,000 for depreciation. Meeting: April 7th.

**Stock Exchange Notices.**—The undermentioned have been ordered to be officially quoted:—

Agricultural and General Engineers.—2,485,632 ordinary shares of 10s. each, fully paid, Nos. 1 to 2,485,632.

Manila Electric Corporation.—280,000 shares of common stock of no nominal or par value.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Siemens Bros. & Co.—45,000 new 10 per cent. cumulative preference shares of £1 each, fully paid, Nos. 360,001 to 405,000.

**Vickers, Ltd.**—No dividend on the ordinary shares for the year 1924.

**Llandudno and Colwyn Bay Electric Railway, Ltd.**—The loss during 1924, after providing for debenture stock redemption, was £1,711. To meet this £1,000 is transferred from the reserve account and £1,667 is brought forward, leaving a balance of £957 to be carried forward to the next account. The receipts showed a reduction of £5,435, and the operating costs were exceptionally heavy owing to the high cost of power and the abnormal amount of track maintenance necessary on account of the wear and tear of omnibus traffic. The cost of reconstructing a portion of the track, as well as the cost of new motor equipments, have been provided out of the proceeds of the additional debenture stock issued during the year.

**South Wales Electric Power Distribution Co.**—The directors' report for 1924 states that the commercial side of the undertaking was operated by the South Wales Power Co. during the year. The latter company, after allowing for depreciation, debenture interest, and cumulative preference dividends, has a credit balance of £24,205, plus £7,712 brought forward, making £31,917. Of this £25,000 is transferred to reserve and the remainder carried forward. The scheme of reorganisation was practically completed during the year.

**Costa Rica Electric Light & Traction Co., Ltd.**—The net earnings of the company in Costa Rica during 1924 rose by £3,033 to £26,277, and the net profit was £9,339, a decrease of £400. To this is added £8,869 brought forward, making £18,208. Owing to the heavy loss on exchange the directors have hitherto been unable to contribute anything to the depreciation account. Accordingly they consider it advisable to place the whole of the surplus to that account. The meeting was held on Wednesday last.

**Pritchett & Gold & E.P.S. Co., Ltd.**—Out of the profits of 1924 it is proposed to pay a dividend of 10 per cent., free of tax, on the ordinary shares (as against 12½ per cent., tax-free); to allocate £3,000 for depreciation; £5,000 to investment depreciation reserve; £1,000 to workmen's compensation reserve; £15,000 to general reserve; and to carry £26,910 forward subject to taxation.

**River Plate Electricity Co., Ltd.**—The net revenue for the past year totalled £55,094, and after deducting administration expenses, &c., and adding £11,308 brought forward, there is an available balance of £49,976. Debenture interest absorbs £3,939; a dividend of 10 per cent. is to be paid on the ordinary stock (as against 8 per cent.); and £12,169 is carried forward. The meeting is to be held on April 6th.

**British Engine, Boiler and Electrical Insurance Co., Ltd.**—The report for the past year states that an interim dividend of 13s. per share was paid in June last, and after transferring £20,000 to the pension fund, and £10,000 to the contingency fund, there remains a balance of £22,731. It is proposed to pay a final dividend of 13s. per share, leaving a balance of £12,454.

**Reading Electric Supply Co., Ltd.**—The report for 1924 shows a revenue of £67,544 (as compared with £60,636 in 1923) and working expenses of £34,418 (£34,280), leaving net revenue of £33,126 (£26,416), to which is added £2,038 brought forward, making £35,164. A dividend of 8 per cent. (as against 6 per cent. in the previous year) is being paid and £2,229 carried forward.

**Prospectus.**—*United States Flexible Metallic Tubing Co., Ltd.*—In order to comply with Stock Exchange Regulations a statement regarding this company and its operations was published in the daily Press on Tuesday last, as permission to deal in 212,000 fully-paid shares is being sought. A dividend has been paid every year for the past 20 years.

**Lancashire Dynamo & Motor Co., Ltd.**—A dividend of 5 per cent. has been declared on the ordinary shares for 1924.

**London Electric Wire Co. & Smiths, Ltd.**—The directors recommend a final dividend of 6¼ per cent. on the ordinary shares, making 7½ per cent. for the year.

**Johnson & Phillips, Ltd.**—At a meeting of the holders of debenture stock last week, resolutions were approved reducing the interest on the outstanding debenture stock from 8 to 6 per cent., and providing for the redemption of the stock at the rate of £102 per cent.

**Rhondda Tramways Co., Ltd.**—The net revenue for 1924 was £40,940, and the addition of £2,889 brought forward makes available £43,829. Of this amount £14,500 is transferred to reserve and renewals accounts, and after paying 8 per cent. on the preference shares, a balance of £3,492 is carried forward.

**Tottenham District Light, Heat and Power Co.**—The *Financial Times* understands that the directors intend to invite tenders for an issue of preference stock from holders of debenture stock and redeemable mortgages.

**Belgian Company.**—The report of the *Société Bruxelloise d'Electricité*, of Brussels, for last year shows a net profit of 1,805,964 fr., as compared with 1,543,871 fr. in 1923.

**German Company.**—The *Rheydt Kabelwerke Gesellschaft* proposes to increase its capital from 5 to 7½ million gold marks—from about £250,000 to £375,000.

**Montevideo Telephone Co., Ltd.**—Interim dividend at the rate of 4 per cent. per annum, less tax.

## Stocks and Shares.

MONDAY EVENING.

THE general tendency of the Stock Exchange markets is dull. The first quarter of the year closes with a good deal of uncertainty in regard to the money outlook, this being accentuated by the talk of a gold standard being once more established in the country. Some people regard the suggestion as indicative of a possible rise in the Bank Rate, and, at any rate, of a disturbance to business in many directions. Hence the dulness that has crept over a good many parts of the Stock Exchange, where business is quiet and enterprise prefers to go softly until the end of the quarter has turned; close upon the heels of which there follow, of course, the Easter holidays.

Electricity supply shares are holding most of their rises. Chelseas are better at 38s. 9d., but the chief feature of the market is the strength of Kensington Ordinary. These shares have advanced £1 within the past two business days, a rise which follows upon another of 10s. a week ago. People in the market are mystified at the remarkable strength displayed by the shares, knowing only that the demand has been extremely emphatic. One of the London companies is said to be going to distribute a cash bonus in the near future, but it is not the Kensington with which rumour thus plays. St. James's are ¼ up at 13¼, and County of London reacted to 53s. 9d. Yorkshire Electrics are better at 1¼. It is anticipated that soon after Easter there will be at least half-a-dozen of the provincial and foreign electrical companies offering new issues for subscription by the public. The London companies are not expected to do anything in this direction until their Bills are safely passed. Westminsters will be dealt in as £1 shares in the early future.

Bromley (Kent) and Wycombe Borough have declared dividends of 10 per cent., tax free. Folkestone Electrics have risen to 39s. The South Wales Power Co.'s report shows that the undertaking makes useful progress: the company manages the South Wales Electrical Power Distribution Co.

The Home Railway market gives no signs of real recovery. Metropolitans and Districts are both unchanged. Underground £10 shares fell back a¼ 2¼. The Southern Railway is opening, on the Wednesday in this week, the first section of its new electrified section, from Victoria to Coulsdon North and Sutton. The Finance Committee of the London County Council announces a deficiency on the working of the L.C.C. tramways of £160,200 for last year. This it is proposed shall be met out of the reserve of £200,900, leaving a balance in that fund of £40,700. The Londoner will probably wonder how long this allowance is likely to last, and will notice, joylessly, that future deficiencies must become a charge on the rates.

A holder of British Thomson-Houston 7 per cent. debenture bemoans having invested money at 108, in stock of which part has just been drawn at 100. It is rather surprising that the price should stand as it does to-day, at 108¼, in view of the fact that a small amount is being paid off annually at par. Similar conditions operate in the cases of the General Electric 7 per cent. mortgage debenture, quoted at 105, and of a few other companies. Investors are obviously ready to accept the risk of repayment, at a loss on their purchase price, in order to obtain the fairly good yields which these stocks afford on the market quotations.

Marconis have become a very uninteresting market, the price hardly changing from Monday morning to Friday night. The new shares, with 5s. paid, are 5s. firmer. Radio Common at 10¼ and the preferred at 10⅛ are also attracting but little attention. Telephone Manufacturing bonds were put up a couple of points to 97. Cable stocks and shares show no movement, except for 1/16th decline, to 5¼, in Chili Telephones. Venezuela Telephones are better at a guinea.

The Southern Counties Electric Light & Power Supply, Ltd., is issuing 20,000 8¼ per cent. participating preference shares (tax free) of £1 each at par, and £15,000 7 per cent. first mortgage debentures at 98. The company's prospectus is reticent upon certain points which the prudent investor would deem essential for his information in connection with electricity supply, and the issues should be left alone by anyone who regards the safety of his capital.

British Columbia Electric Railway stocks continue depressed. Both deferred and preferred are down 2, and it would appear as though the prejudice created in the mind of the British investor against anything Canadian is being extended to the more western province. British Electric Traction ordinary has gained 1. British Automobile Tractions were not affected by a satisfactory report, out a few days ago. Mexicans are dull.

Babcock & Wilcox eased off to 55s.; Cromptons are 1/16th lower at 13s. 9d. middle. Cable manufacturing shares hold steadily to their recent improvements. Enfield Cable ordinary are 53s. 9d. A further substantial rise in the price of raw rubber caused a hardening of the share market without compelling, however, any particular accession of general business. The tardiness of the market to respond to the brighter conditions is arousing surprise in many circles.

# Share List of Electrical Companies.

### Home Electricity Companies.

| | Nom. £ | Dividend. 1923. | 1924. | Price Mar. 30. 1925. | Rise or fall. | Yield. p.c. |
|---|---|---|---|---|---|---|
| Bournemouth and Poole ... | 1 | 13 | 14 | 2½ | — | 4 19 8 |
| Brompton Ordinary ... ... | 1 | 10 | 10 | 1⅝ | — | *5 6 8 |
| Charing Cross Ordinary ... ... | 1 | 14½ | 15 | 45/- | — | 6 13 4 |
| do. do. do. 4½ Pref. | 1 | 4½ | 4½ | 17/6 | — | 5 2 10 |
| Chelsea ... ... ... ... | 1 | 12 | 12 | 38/9 | — ⅛ | 6 4 0 |
| City of London ... ... ... | 1 | 15 | 15 | 48/6 | — | 6 3 8 |
| do. do. 6% Pref. | 1 | 6 | 6 | 23/6 | — | 5 2 2 |
| Clyde Valley ... ... ... | 1 | 8 | 8 | 32/6 | — | 4 16 6 |
| County of London ... ... | 1 | 15 | 15 | 68/9xd | + ⅜ | 5 11 6 |
| do. do. 6% Pref. | 1 | 6 | 6 | 23/-xd | — | 5 4 4 |
| Edmundson's Ordinary ... | 1 | 7 | — | 23/- | — | 6 1 9 |
| do. 7% Pref. ... ... | 1 | 6 | — | 23/- | — | 6 1 9 |
| Elec. Supply Corporation ... | | 10 | 10 | 32/6 | +1/3 | 6 8 0 |
| Kensington Ordinary ... ... | 5 | 14 | 15 | 123½xd | +1 | 5 17 8 |
| Lancs. Light and Power ... | 1 | 7½ | 7½ | 27/6 | — | 5 9 1 |
| London Electric ... ... ... | 1 | 10 | 10 | 37/6 | — | 5 6 8 |
| do. do. 6% Pref. ... | 5 | 6 | 6 | 5½ | — | 5 9 1 |
| Metropolitan ... ... ... | 1 | 10 | 11 | 38/3 | — | 5 15 0 |
| do. 4½% Pref. ... ... | 1 | 4½ | 4½ | 17/6 | — | 5 2 10 |
| Midland Counties ... ... ... | 1 | 5½ | 6 | 23/0 | +¢d. | 5 1 3 |
| Newcastle-on-Tyne Ordinary ... | 1 | 6 | 7 | 25/- | — | 5 12 0 |
| do. 5% Pref. ... | 1 | 5 | 5 | 18/9 | — | 5 6 8 |
| do. 7% Pref. ... | 1 | 7 | 7 | 25/6 | — | 5 9 10 |
| Notting Hill 6% Pref. ... ... | 10 | 6 | 6 | 10 | — | 6 0 0 |
| North Met. Elec. 6% Pref. ... | 1 | 6 | 6 | 1½ | — | 5 6 8 |
| St. James' and Pall Mall ... | 5 | 17½ | 17½ | 13½ | + ½ | 6 13 4 |
| South London ... ... ... | 1 | 15 | 15 | 2⅞ | — | 5 17 0 |
| South Metropolitan Pref. ... | | 7 | 7 | 1½ | — | 5 12 0 |
| Urban Ordinary ... ... ... | 1 | 4 | — | 1⅛ | — | 3 15 4 |
| do. 6% Pref. ... | 1 | 6 | — | 20/6 | — | 5 17 1 |
| Westminster Ordinary ... ... | 5 | 15 | 15 | 10½ | — | 7 2 10 |
| Whitehall Elec. Invst. 7½% Pref. | 1 | 7½ | 7½ | 19/9 xd | — | 7 12 11 |
| Yorkshire Elec. ... ... ... | 1 | 8 | 8 | 30/- | +6d. | 5 6 8 |

### Home Rails.

| | | | | | | |
|---|---|---|---|---|---|---|
| Central London Ord. Assented Stock | 4 | 4 | 70 | — | 5 14 4 |
| Metropolitan ... ... ... ,, | 4 | 5 | 78½ | — | 6 7 5 |
| do. District ... ... ,, | 3½ | 3½ | 49 | — | 7 2 10 |
| Underground Electric Ordinary | 10 | Nil | Nil | 2⅜ | — ½ | Nil |
| do. do. "A" ... | 1/- | Nil | Nil | 8/- | — | Nil |
| do. do. Income | Bonds | 6 | 6 | 97 | — | *6 3 9 |

### Telegraphs and Telephones.

| | | Dividend. 1922. | 1923. | | | |
|---|---|---|---|---|---|---|
| Anglo-Am. Tel. Pref. ... ... | Stock | 6 | 6 | 105 | — | 5 14 3 |
| do. Def. ... ... | ,, | 1½ | 1½ | 24 | — | 6 5 0 |
| Automatic Telephone ... ... | 1 | Nil | 3 | 1½ | — | 3 8 7 |
| Chili Telephone ... ... ... | 5 | 6 | 6 | 5½ | — ⅜ | *5 9 1 |
| Cuba Sub. Ord. ... ... ... | 10 | 7 | 7 | 7½ | — | 9 13 2 |
| Eastern Extension ... ... | 10 | 10 | 10 | 17½ | — | *5 12 8 |
| Eastern Tel. Ord. ... ... | Stock | 10 | 10 | 176½ | — | *5 13 4 |
| Globe Tel. and T. Ord. ... ... | 10 | 10 | 10 | 18 | — | *5 11 1 |
| do. do. Pref. ... ... | 10 | 6 | 6 | 11½ | — | 5 7 10 |
| Great Northern Tel. ... ... | 10 | 24 | 22 | 82 | — | 6 17 6 |
| Indo-European ... ... ... | 25 | 7 | 7 | 32½ | — | *5 6 1 |
| Marconi ... ... ... ... | 1 | 15 | 10 | 1⅝ | — | 5 14 6 |
| Marconi Marine ... ... ... | 1 | 10 | 10 | 1⅜ | — | 8 17 10 |
| Oriental Telephone Ord. ... | 1 | 12 | 12 | 2⅜ | — | *5 12 11 |
| United R. Plate Tel. ... ... | 5 | 8 | 8 | 7 | — | *5 13 0 |
| Western Telegraph ... ... | 10 | 10 | 10 | 17½ | — | *5 15 11 |

### Home and Foreign Trams, &c.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Arg. Trams First Pref. ... | 5 | 12½ | 5½ | 8¼ | — | 8 9 2 |
| do. do. 2nd Pref. ... | 5 | 5½ | 6 | 8 | — | 10 0 0 |
| do. do. 5% Deb. ... | Stock | 5 | 5 | 73½ | — | 6 12 5 |
| British Electric Traction Ord. ... | ,, | 5 | 6 | 102½ | +1 | 5 17 8 |
| do. do. 6% Pref. ... | ,, | 6 | 6 | 105¾ | −1 | 5 18 9 |
| Brazil Traction ... ... ... | 100 | 4 | 4 | 55 | — ½ | 7 4 2 |
| Brit. Columbia Elec. Rly. Pcs. | Stock | 5 | 5 | 90½ | — | 5 10 6 |
| do. do. Preferred | ,, | 5 | 96/- | 88½ | −2 | *5 8 4 |
| do. do. Deferred | ,, | 8 | 122/5 | 106½ | −2 | *6 1 6 |
| do. do. Deb. | ,, | 4½ | 4½ | 79½ | — | 5 6 11 |
| Lond. & Sub. Trac. 5% Pref. ... | 1 | 5 | 2½ | 5/6 | — | Nil |
| London United Tram. Deb. ... | Stock | 4 | 4 | 49½ | — | 8 1 7 |
| Mexico Trams, 5% Bonds ... | — | Nil | 5 | 70 | — | 7 2 10 |
| Mexican Light Common ... | 100 | Nil | Nil | 25 | — | Nil |
| do. Pref. ... ... | 100 | Nil | Nil | 60½ | −2 | Nil |
| do. 1st Bonds ... | — | 5 | 5 | 69½ | — | 7 3 11 |
| Yorkshire (West Riding) ... | 1 | — | 5 | 1 | — | 5 0 0 |

### Manufacturing Companies.

| | | | | | | |
|---|---|---|---|---|---|---|
| Babcock & Wilcox ... ... | 1 | 20 | 12 | 55/- | — ⅛ | *4 7 3 |
| British Aluminium Ord. ... ... | 1 | 5 | 5 | 33/3 | — | 3 0 2 |
| British Elec. Transformer Pref. | 1 | Nil | Nil | 17/6 | — | ... ... |
| British Insulated Ord. ... ... | 1 | 15 | 15 | 3¼ | — | 4 16 0 |
| Brush Ord. ... ... ... ... | 1 | 10 | 10 | 28/3 | — | 7 12 4 |
| Callenders ... ... ... ... | 1 | 15 | 15 | 3⅝ | — | 4 12 4 |
| do. 6½% Pref. ... ... | 1 | 6½ | 6½ | 23/9 | — | 5 9 5 |
| Crompton Ord. ... ... ... | 1 | 5 | Nil | ⅛ | — ⅛ | ... ... |
| Edison-Swan ... ... ... | 4/- | 7½ | 10 | 7/9 | — | 5 9 2 |
| do. 5% Deb. ... ... | Stock | 5 | 5 | 81½ | — | 6 0 3 |
| Electric Construction ... ... | 1 | 10 | 10 | 32/6 | — | 6 3 1 |
| Enfield Cable, Pref. ... ... | 1 | 7½ | 7½ | 1⅛ | — | 6 0 0 |
| English Electric ... ... ... | 1 | 8 | 5 | 20/- | — | 6 0 0 |
| do. do. Pref. ... ... | 1 | 6 | 6 | 21/- | — | 5 14 3 |
| Gen. Elec. Pref. ... ... ... | 1 | 6½ | 6½ | 23/6 | — | 5 10 8 |
| do. Ord. ... ... ... | 1 | 5 | 5 | 23/- | — | 4 16 11 |
| Henley ... ... ... ... | 1 | 15 | 15 | 3⅝ | — | 4 14 1 |
| do. 4½% Pref. ... ... ... | 5 | 4½ | 4½ | 4½ | — | 5 6 6 |
| India-Rubber ... ... ... | 1 | 10 | 5 | 19/6 | — | *5 2 7 |
| Johnson & Phillips ... ... | 1 | 5 | 5 | 1⅛ | — | 4 0 |
| Met-Vickers, Ord.... ... ... | 1 | 19½ | 8 | 24/6 | — | 6 10 8 |
| do. Pref.... ... ... | 2 | 8 | 8 | 2½ | — | 6 8 0 |
| Siemens Ord. ... ... ... | 1 | 5 | — | 26/6 | — | 3 15 6 |
| Telegraph Construction ... | 15 | 20 | 20 | 97 | — | *4 14 1 |

* Dividends paid free of Income Tax.

# Market Quotations for Chemicals and Metals.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

| CHEMICALS, &c. | | Price Mar. 31. | Fortnight's Inc. or dec. |
|---|---|---|---|
| a Acid, Oxalic ... ... ... ... | per lb. | 6½d. | ... |
| a Ammoniac, Sal ... ... ... | per ton | £60 | ... |
| a Ammonia, Muriate (large crystal) | ,, | £33 | ... |
| a Bisulphide of Carbon ... ... | ,, | ... | ... |
| a Borax ... ... ... ... ... | ,, | £35 | ... |
| a Copper Sulphate ... ... ... | ,, | £25 10s. | ... |
| a Potash, Chlorate ... ... ... | per lb. | 4d. to 4½d. | ... |
| a ,, Perchlorate ... ... | ,, | 5½d. | ... |
| a Shellac ... ... ... ... | per cwt. | £15 15s. | ... |
| a Sulphur, Sublimed Flowers ... | ,, | £7 15s. | ... |
| a ,, Roll ... ... ... | ,, | £7 15s. | ... |
| a Soda, Chlorate ... ... ... | per lb. | 2½d. to 2¾d. | ... |
| a ,, Crystals ... ... ... | per ton | £5 to £5 5s. | ... |
| a Sodium Bichromate, casks ... | per lb. | 4d. | ... |
| **METALS, &c.** | | | |
| b Aluminium, Ingots ... ... | per ton | £120 to £125 | ... |
| b ,, Wire ... ... ... | per lb. | 1/9 to 2/6* | ... |
| b ,, Sheet ... ... ... | ,, | 1/6 to 2/- | ... |
| p Babbitt's Metal and Anti-friction Metal— | | | ... |
| Grade I ... ... ... | per ton net | £224 | £1 dec. |
| Grade II ... ... ... | ,, ,, | £162 | ... |
| Grade III ... ... ... | ,, ,, | £93 | ... |
| c Brass (rolled metal 2" to 12" basis) | per lb. | 9½d. | ½d. dec. |
| c ,, Tubes (solid drawn) ... | ,, | 1/- to 1/0½ | ½d. dec. |
| c ,, Wire, basis ... ... ... | ,, | 9½d. | ½d. dec. |
| c Copper Tubes (solid drawn) ... | ,, | 1/1½ | ½d dec. |
| c ,, Bars (best selected) ... | per ton | £90 | £5 dec. |
| c ,, Sheet ... ... ... | ,, | £90 | £5 dec. |
| c ,, Rod ... ... ... ... | ,, | £90 | £5 dec. |
| d ,, (Electrolytic) Bars ... | ,, | £64 15s. | £4 dec. |
| d ,, Sheets ... | ,, | £143 10s. | ... |
| d ,, ,, Wire Rods | ,, | £74 15s. | £4 dec. |
| d ,, ,, H.C. Wire | per lb. | 9¾d. | ½d. dec. |
| f Ebonite Rod ... ... ... ... | ,, | 2/- to 3/6 | ... |
| f Sheet ... ... ... ... | ,, | 2/- to 3/6 | ... |
| n German Silver Wire ... ... | ,, | 2/3 | ... |
| h Gutta-percha, fine ... ... | ,, | 6/6 | ... |
| h India-rubber, Para fine ... ... | ,, | 1/6½ | 1d. inc. |
| l Iron Pig (Cleveland Warrants) ... | per ton. | nom. | ... |
| l ,, Wire, galv. No. 8, P.O. qual. | ,, | £29 | ... |
| g Lead, English Pig ... ... ... | ,, | £26 5s. | £2 10s. dec. |
| g Mercury ... ... ... ... | per bot. | £14 to £14 5s. | 10/- dec. |
| e Mica (in original cases) small ... | per lb. | 3d. to 5/- | ... |
| e ,, ,, medium | ,, | 4/- to 8/- | ... |
| e ,, ,, large ... | ,, | 10/- to 20/- & up. | ... |
| p Phosphor Bronze, plain castings | ,, | 1/3½ | ... |
| p ,, ,, drawn bars & rods | ,, | 1/3 | ... |
| p ,, ,, rolled strip & sheet | ,, | 1/3½ | ... |
| p ,, ,, wire ... ... ... | ,, | 1/4 | ... |
| o Platinum ... ... ... ... | per oz. | £26 | ... |
| d Silicium Bronze Wire ... ... | per lb. | 1/0½ | ... |
| r Steel, Magnet, in bars ... ... | ,, | 7½d. | ... |
| e Tin, Block (English) ... ... | per ton. | £237 to £237 10s. | £5 5s. dec. |
| s ,, Wire, Nos. 1 to 16 ... ... | per lb. | 4/11 | 9d. inc. |

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
l Bolling & Lowe.
r Richard Johnson & Nephew Ltd.
s P. Ormiston & Sons.
o Johnson, Mathey & Co., Ltd.
p C. Clifford & Son, Ltd.

W. F. Dennis & Co.

**Rectifier Sub-Stations for Victorian Government Railways.** — We learn that as a result of visits paid by the Victorian Government Authorities to the rectifier sub-stations on the French Midi Railway, the Victorian Government has decided to equip the new sub-stations required in connection with extensions to the Victorian Government Railways, with automatically operated rectifier plants of the heavy steel Brown-Boveri pattern.

Messrs. Brown-Boveri & Co., Ltd., have received orders for completely equipping the two sub-stations at Mooroolbank and Lower Ferntree Gulley. Each sub-station will be provided with a 900-kW transforming and rectifying set, which will include two type GRZ 156 rectifiers, converting the three-phase supply at 17,000/19,000 V, 25 periods, to 1,500 V., d.c. Each set is to be capable of carrying overloads, after eight hours' working at full load, of 50 per cent. for two hours and 270 per cent. for thirty seconds.

The sub-stations will be provided with fully automatic equipment, so that they can be controlled automatically at set times or on the occurrence of certain conditions at the contact wire. The plant will be operated under the various conditions by means of a simple selector switch, and in this way it will be possible to fulfil every condition that is likely to be met in a modern automatic sub-station.

We understand that 80 per cent. of the Brown-Boveri rectifiers that have been installed are used in connection with traction services, either tramway or railway.

**Atomic Bombardment.**—It is reported that a direct-current generator capable of producing 600,000 volts is being installed at the University of Paris, with the aid of which it is proposed this summer to attempt forcibly to cause a gold atom to absorb an alpha particle, which, if successful, will probably convert it into an atom of mercury.

# Heating Valve Filaments by Alternating Current.

By W. REDMAYNE.

I have received several queries with reference to the article on the above subject which recently appeared in the Electrical Review. Some of these are perhaps due to the difficulty of distinguishing between inductances and resistances in the illustrations, the draughtsman having given the former a somewhat anæmic appearance.

One correspondent has mistaken the variable grid leak from the detector grid for a potentiometer; this variable grid leak is not vital, and a fixed leak can be used. There is, of course, a "best value," and this, and in fact all adjustments, are more important with alternating current than with accumulators.

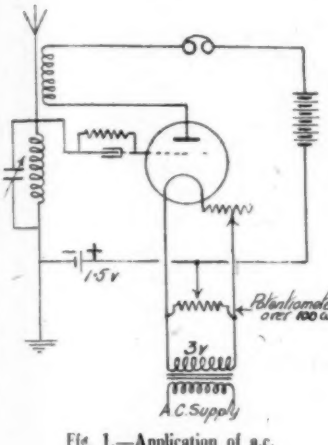


Fig. 1.—Application of a.c. to Single Valve.

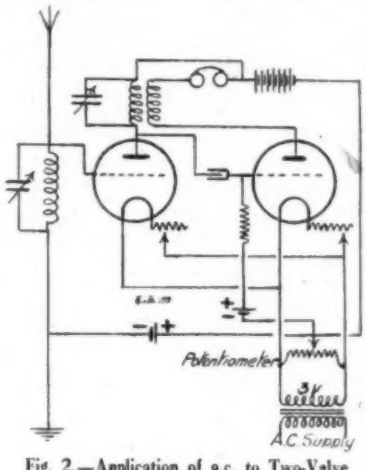


Fig. 2.—Application of a.c. to Two-Valve H.F. and Detector.

Others have been reluctant to use the circuit, because of the supposed complication of potentiometer and compensating windings; these were only referred to in the article as a matter of experimental interest. A receiving set consisting of one, two, or three valves, can be used on alternating current and, with careful adjustment of reaction, will give results which cannot be distinguished from a similar set used with an accumulator, without any compensating device other than the use of the cells for the purpose of biassing the grids, and, of course, the correct type of valve.

The rewinding of the small transformer appears to deter others from making the change to alternating current; this can be avoided by the use of the 3-volt winding already existing on the small "bell-ringing" transformers, but in this case other means of obtaining a neutral point, from which to take the grid bias, have to be adopted as shown in the illustrations.

If the existing filament rheostats are too low in resistance for use on 3 volts with the 1-volt valves, an extra resistance can easily be added. Fig. 1 illustrates the application of alternating current to a single valve, with reaction on the a.t.i.; this also applies to most "super" single valve circuits. In this and the following diagrams essential features only are shown, and all inductances, condensers, &c., have normal values. Other methods of tuning than those shown may, of course, be used.

Fig. 2 illustrates the application to a two-valve h.f. and detector, which appears to be the set most commonly used.

Fig. 3 illustrates the application to a crystal with valve amplifier, and fig. 4 the application to a valve-crystal dual.

It will be noted that, instead of a mid-point tap on the transformer, use is made of a potentiometer to obtain an artificial neutral point; this will not be at the mid-point, as the three volts available from the transformer are not utilised in the valve filament, two volts being absorbed in the rheostat. This arrangement has the advantage that the filament temperature of each valve can be controlled separately if necessary, and that the set can be supplied alternatively from alternating current or from an accumulator, without any change in the internal connections. When supplied from an accumulator the potentiometer serves a useful purpose in enabling the best grid potential to be secured.

I have been asked how the arrangement would work on 100 cycles. I have no facilities for trying this, but the results would obviously be better as regards the disturbance due to filament temperature variations, as the filament would not have as long a time in which to cool between the maxima.

To those who are experimentally inclined it will be of interest to note that in a three or four valve set with three volts applied through rheostats, and using a potentiometer to create a neutral point, each valve appears to produce a note of different frequency to the others when so adjusted that the potentiometer neutral does not correspond to the mean potential of the filament. Any maladjustment of the potentiometer thus appears to produce a disturbing "chord" with a dominant note and weaker component notes, which can be varied by the adjustment of the filament rheostats. I should like to have more expert confirmation of, and comment on, this phenomenon, which appears to depend to some extent on the alternator in use at the power station.

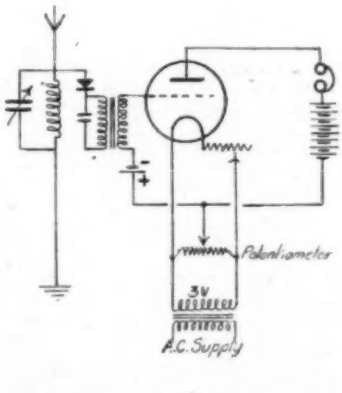


Fig. 3.—Application of a.c. to Crystal with Valve Amplifier.

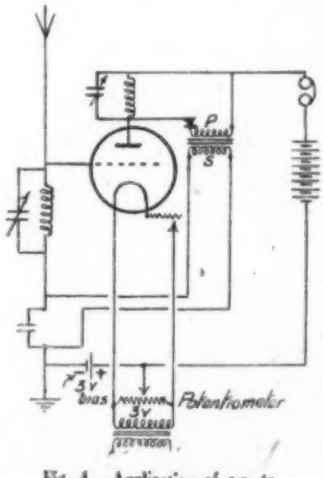


Fig. 4.—Application of a.c. to Valve-crystal Dual.

# The Work of the B.E.A.M.A. during 1924.

## The Report of the Council.

The Council, in submitting its report at the annual meeting on March 19th, stated that the volume of heavy plant business had not been unsatisfactory during 1924, considering general conditions, although the turnover of 1923 was not maintained.

In the business in small motors and switchgear the turnover lagged behind, but a corresponding development might be expected in the near future. A satisfactory feature was the increasing demand for domestic appliances such as electric cookers.

Although results generally were not unsatisfactory, a considerable expansion had still to take place before the turnover would reach the magnitude indicated by the rate of increase in the years before the war. This was particularly the case in electrical and allied plant required for industrial developments, and was an indication of the general depression in manufacture generally throughout the country.

The output of the factories had been largely in connection with the development of power stations, and this, in itself, was a gratifying feature. The increased electric power available and the prospective lower rates for power consequent on more efficient methods of generation should lead to an extended application of electric driving in all industries.

A less satisfactory feature was the increasing growth of foreign competition, which had had the result of depressing prices, although the actual number of orders placed abroad had not reached any considerable magnitude. The industry was placed in a difficult situation through this competition coming from countries with protected home markets where the hours of working were longer and the wages lower than in this country, and materials were obtainable at prices considerably less than those of the home factories.

"If the electrical industry and the other industries of the country, many of which are the suppliers of our raw material or partly manufactured parts, are to become more actively engaged and provide work for the unemployed, it is essential that orders for plant should be kept at home. Municipalities and corporations have, with a few exceptions, been most loyal in supporting the home factories."

Export work showed some increase, and one of its most satisfactory features was the large amount of plant required for railway electrification and hydro-electric power stations. Members are now able to supply hydro-electric plant of the largest size and of a quality and design which is unexcelled. There is a similar indication of active development work in the department of electric railway equipments; for, while the railway companies have done comparatively little in electrification, members have pushed on with their designs and have been able to compete successfully with foreign competitors for electric railway work abroad. Members have thus demonstrated their ability to carry out such work on the largest scale. It is hoped that British railways will not delay in electrifying their own lines.

In spite of difficult financial conditions, the Association has been unremitting in all its constructive work. The Electrical Research Association is gradually producing results of greater value and utility, and standardisation work has continued with the same energy as before. While electrical publicity through the Electrical Development Association has been actively pursued in conjunction with the municipalities and supply companies, it is essential that this work should be continued on a larger scale, but for this more active support is necessary from those engaged in electricity supply.

Though still in a somewhat difficult position and with the prospect of increasing competition, the industry may look forward to larger developments at home and overseas, if that co-operation, already so valuable, between members, the supply industry, and other purchasers can be continued and increased.

The work of the Association in connection with the British Empire Exhibition is reviewed with satisfaction, and the Council adds:—"The question has been frequently asked whether the Section was a success from the point of view of the exhibitor. . . . Some of the makers of lighter articles and appliances have expressed a certain degree of satisfaction with the number of orders and inquiries received, whilst others have not been able to give a favourable report. With regard to the heavy plant: no manufacturer expected to be able to trace any immediate result, but all exhibitors can rest satisfied that they gave a display which has probably never been equalled in any country, and can await with confidence the growth of the industry, well knowing that the electrical machinery and apparatus produced in this country is unexcelled in quality and design."

One outcome of the Exhibition was the series of British Empire trade conferences held in September, at the initiative of the New Zealand representative, for the purpose of fostering inter-Empire trade and bringing about closer personal relations between the representatives of the Dominions and Colonies and those of the home industries.

The meeting on electrical and allied engineering was organised by the Association.

In the course of its review of the first World Power Conference, the Committee says that international conferences of this type are one of the surest means of securing the adoption of international standards in design and manufacture, thus speeding the progress of electrification throughout the world.

The Council is of opinion that the proceedings generally, and all the arrangements made, reflect the greatest credit upon the Director, aided by his efficient staff.

The Association was invited to appear before the B.O.T. Committee on Industry and Trade, and evidence was submitted pointing to the necessity, if our home and foreign trade is to resist foreign competition, for some national scheme in furtherance of an immensely extended use of electricity and the consequent cheapening of supply; greater financial facilities, more assistance to research, better commercial intelligence, &c.

The Association was invited to assist in the preparation of the Schedules of Information, Compulsory and Voluntary, required for the Census of Production, 1924. It is hoped that, as a result of this co-operation with the Government Department, it will be possible for the returns to be made with as little trouble to manufacturers as possible.

The Export Committee gave attention during the year to the new regulations fixing the qualification for admission of goods under British preferential rates, which comes into operation in Australia and New Zealand on April 1st, 1925. To qualify for this preference it is essential that 75 per cent. of the value should be the product of British material and/or labour. Members were consulted as to the effect of this upon their products, and there appears to be general agreement that it will have no detrimental effect, provided that due regard is given by the Dominion Customs authorities to the state in which the various raw materials are normally imported into the United Kingdom.

A large number of members readily and generously met requests by the War Office for the intensive training of Army officers over short periods of time in various branches of electrical engineering. During the last five years nearly 50 officers have availed themselves, with considerable advantage, of the facilities thus afforded them.

The Electrical Research Association has now completed the fourth year of its existence, and is steadily gaining increased recognition. Some notes of the principal results during the year are given below, and fuller details will be found in the annual report recently published.

There is a strong feeling that inquiries on more purely scientific lines should be undertaken as soon as possible, and in the one instance, *viz.*, the research on oil circuit breakers, in which fundamental work has been attempted, results are being obtained which will lead to material improvement in current practice.

Amongst the results of a practical nature may be mentioned the following: In the case of fibrous *insulating materials*, a better understanding has been reached of the requirements, and co-operation amongst those concerned has brought about substantial improvements in the quality of the material through the preparation of agreed purchasing specifications. A similar stage has been reached in the case of *paper, insulating varnishes, synthetic resins, vulcanised fibre*, and *press boards*. Corresponding progress has also been made in the study of *natural silk*, and *asbestos*, which has led to great improvement in the quality of these materials for insulating purposes, while artificial silk has also been dealt with. Continued progress has been made in the work on *insulating oils*, and the specification already issued by the B.E.S.A., which was based on the former work of the E.R.A., has been revised, and an additional class of oil introduced. Successful work has also been carried out on the *heat-resisting properties of insulating material*.

The research work on the safe loading of British standard *cables* for use up to 11,000 V in a wide range of service conditions reached the stage of publication last year. Additions have now been made to that work, including a study of the problem of dielectric loss measurement and the safe working temperature of the insulating materials employed.

The important research on *circuit breakers* has been continued in full activity, and it is evident that the 50,000 or more test results obtained are leading to a better understanding of the principles involved.

In connection with *condenser* and *steam turbines*, a study of heat transmission co-efficients for condensers has been completed and a problem for future work laid down, while the investigation on steam turbine *nozzles* has made good progress. The work on the *specific heat of steam* at pressures up to 500 lb. per sq. in. and temperatures up to 500 deg. C. is nearly completed, and, arising out of this research, extended steam tables have been prepared and published.

The Council accepted the recommendation of the Education Committee that it should grant 10 scholarships during the year, five in electrical and one in mechanical engineering.

The standard of knowledge and ability of the candidates was again satisfactory. Renewals of their previous scholarships were given to four scholars.

The number of overseas students in members' works was 136, an increase of 11. The Education Committee has continued its consideration of a comprehensive scheme for the education of Dominion students and persons in non-competing countries overseas. Activities must be limited for the present to informing inquirers and interested parties that the Association regards it as part of its business to assist students to conclude arrangements for training with members' firms, and to advise them as to technical colleges, books, &c.

The drafting of specifications for turbo-alternators and other large electrical generators, now practically completed, represented the most formidable task of the Standardisation Committee during 1924. In addition to the discussions within the interested sections, and jointly between them and the Standardisation Committee, many joint discussions on the performance of these machines have taken place in the I.M.E.A.- B.E.A.M.A. Committee, and agreement between these closely related bodies has now been reached on all important questions. These discussions are supplementary and complementary to those in the B.E.S.A. committees and panels, upon which both Associations are represented, and must greatly facilitate the work of that Association.

Other specifications upon which agreement has now been reached include those for reciprocating steam engines, gas engines, and heavy oil engines, both of the surface ignition and Diesel types. A different question, and one which has delayed the issue of these specifications, has been the amount of cyclic irregularity which may be permitted in reciprocating engines when driving electric generators. Hitherto, an irregularity of 1/150 has been allowed, but it has now been agreed that 1/75 may in future be permitted in certain cases.

As a result of long-continued consideration, extending over nearly two years, a standard definition of flame-proof enclosure and methods of test to prove compliance therewith have been agreed between the Association, the B.E.S.A., and the Mines Department. The sections chiefly interested are the Dynamo and Motor, Switchgear and Instrument Sections. It has also been agreed that the recognised authority for issuing test certificates shall be the Sheffield University, which has set up a special department for flameproof testing, under the direction of an officer nominated by the Mines Department. The Switchgear Section, by its Technical Committee, has made a careful investigation of the actual electrical conditions to be complied with in underground colliery workings, and has issued a report on the subject setting out in tabular form the values of the short-circuit currents which may occur at various points in a mine.

Among the important works now under consideration, in collaboration with the B.E.S.A., is the standardisation of field regulators, illuminating materials, rotary converters, flameproof and other mining-type motors, colliery requisites, fractional horse-power motors, bus-bars and connections, synthetic resins, paints and varnishes, non-ferrous alloys for electrical purposes, vulcanised fibre, and industrial plugs and sockets, in addition to the revisions (now nearly completed) of the specifications for transformers, instrument transformers, and instruments and meters. A special committee on terminal markings has been set up with a view to evolving a logical and comprehensive system capable of general application. The standardisation of water-turbine nomenclature, draughtsmen's conventions, and abbreviations is also under consideration.

A number of B.E.S.A. specifications of interest to members were published during the year. Much quiet and painstaking work is hidden beneath the finished result as shown in these B.E.S.A. specifications; and in no department of the Association's activities does the spirit of co-operation appear to greater advantage than in technical committees, where the members freely exchange ideas and pool their experience and theoretical knowledge for the common benefit of the whole.

In August last H.M. Mines Department issued a revised edition of "Mines and Quarries Form No. 11," which contains the general regulations as to the installation and use of electricity in mines. The principal alterations made in the memorandum, as a result of discussions with sections of the Association, are in the notes under Regulations 127 (v) and 132 (i), which deal with the nature of flameproof enclosure, or enclosure to prevent open sparking. In the previous edition, the inspector had recommended the purchaser to obtain from the manufacturer a guarantee that the apparatus supplied by him (for use in situations where inflammable gas was likely to occur) was designed and constructed so as to be safe for use in an explosive atmosphere. The manufacturers did not feel justified in undertaking so serious a responsibility, and, as a result of the discussions, it was agreed that where the risks mentioned in the Regulations existed the apparatus supplied should comply with any British standard specification covering flameproof apparatus.

At the termination of the joint discussions referred to above, H.M. Electrical Inspector of Mines expressed his appreciation of the help afforded to him by members of the Association, and in his annual report he says:—"It is fitting to make acknowledgment in this report of the frank and helpful manner in which manufacturers of electrical apparatus for mining use have dealt with criticisms and suggestions addressed to them, arising out of matters that have come to my notice during the course of my duties."

The Council expressed appreciation of the friendly spirit of co-operation shown by H.M. Electrical Inspector of Mines in all the discussions which have taken place with manufacturers on this work of national importance.

Regarding the new edition of the I.E.E. Wiring Rules, the report says:—"They naturally provoked a certain amount of criticism in the Press and amongst our own members. Your representatives on the Committee had, throughout, put forward the views of members, but unfortunately they were in some important cases ruled out by the majority vote of the Committee. It is, however, evident that some revision will have to be made in order to render the rules generally acceptable to the various sections of the industry, and the matter is now under discussion."

The Industrial Solicitor reports a quiet year in the department of conditions of contract.

A new short set of conditions for home business, excluding erection work, was issued by the I.E.E., under the title of "Model Form of General Conditions for the Sale of Goods other than Cables." This document represents the considered work of a joint committee on which were represented this Association, the municipalities, and the contractors. The Council has not yet made any rule governing the use of the set.

The B.E.A.M.A. does not ordinarily deal with labour matters, but refers them to the Engineering Employers' Federation. In the course of settling conditions of contract, however, labour questions arise on what are called the Fair Wages Clauses, in which connection the Association long ago adopted and put into use the clauses recommended by the Fair Wages Advisory Committee under resolutions passed by the House of Commons. These clauses provide that wages and hours shall be not less favourable to labour than those commonly recognised by employers and unions in the district where the work is carried out (*i.e.*, where the factory is situated), or, if none in that district, then those of the nearest district in which the general industrial conditions are similar. Until recently these provisions have not been the subject of serious dispute, but efforts are now being made by certain municipalities to provide that on "erection jobs," that is, work outside of the factory (which may be in any district), only trade union labour shall be employed, and wages paid ruling in the district where the work is carried out. The Council is in touch with the Engineering Employers' Federation on the subject.

With reference to the new I.E.E. set of export conditions, the Joint Committee found that the work would run more conveniently into two sections, separately covering different classes of contract, and drafts have now been prepared in that form. In Australia, largely through the work of the Overseas Committee there, a standard set of conditions of contract has been adopted by all interested parties. In South Africa a similar effort is being made to introduce a standard set.

The Committee next reviews the work of the year in connection with schedules of standard railway charges; exceptional railway rates; and special vehicles for heavy weights.

The Electrical Development Association reports a further net increase in its membership, from 1,166 to 1,172, the membership of the four main classes now standing as follows: Municipal undertakings, 100 (last report, 97); company, 87 (85); manufacturers, 244 (244); contractors, &c., 741 (740); total, 1,172 (1,166). A number of undertakings have increased the amount of their annual subscription. In addition to the ordinary revenue, nearly £25,000 was contributed by 264 supply undertakings towards the display organised by the E.D.A. at the British Empire Exhibition. The various other activities of the E.D.A. are briefly reviewed.

The Committee was engaged at the date of the last report on an analysis of cost accounting towards the preparation of a draft to be submitted to the Sections, but further consideration disclosed the necessity of conferences with the Sections themselves if sure progress were to be made. Many such conferences have been held and the draft is well forward.

The response of members to the appeal for equipment for the Royal Technical College, Glasgow, and for the Christchurch (N.Z.) School of Engineering is mentioned.

The subject of B.E.A.M.A. exhibition policy is alluded to thus:—"Your Council have noticed with regret a tendency to return to the condition of things in 1922—the pre-Wembley days—when all sorts of exhibitions were promoted by municipal and private enterprise, overlapping as to subject, conflicting in date, and generally without system of any sort, to the great perplexity of those who would wish to place no unnecessary bar in the way of the encouragement of the use of electricity. The movement began even before Wembley had closed its doors in October last, and has since grown almost to an epidemic. The taking a hand in such exhibitions by members is, by a clever system of 'snowballing,' rendered almost an obligation for them, and your Council have recently been rather lenient in granting applications under the standing rule, but they now feel that the whole position will have to be reconsidered."

The Turbine and Condenser Cross-Tendering Agreement underwent complete revision during the year, and has been re-issued under the title of the Turbine and Condenser Tendering Agreement. The new text, while retaining most of the provisions of the earlier one and adding some new ones, now permits combined tenders under certain conditions.

# Electric Cooking Problems.

Mr. R. Hardie, of the Glasgow Corporation Electricity Department, read a paper upon the above subject at a Salesmanship Conference at Leeds on April 2nd.

At the outset he emphasised the fact that the questions of installation cost, hire charge, and most important, running costs, weighed very largely with consumers in coming to a decision with regard to electric cooking. For four years past the Glasgow domestic tariff on the maximum demand system had been 4½d. per kWh, rebate rate 1d., or on the multi-part tariff, a fixed annual charge of 12½ per cent. of assessed rental (excluding local rates) plus a running charge of ½d. per kWh. The hire charge for cookers was £1 for the first year, and 10s. per annum thereafter. For that sum the Department installed the special wiring, costing £2 10s., together with a kettle and kettleboard costing 30s., a total capital outlay of approximately £16. It might be stated with confidence that the modern electric cooker was, in the hands of average, careful operators, satisfactory, owing to the improvements which had been made during the past three or four years. The supply authority which, by the channel of demonstration in the home, was in direct contact with the housewife, learned not only of the good points of the cooker, but its shortcomings, and in self-protection was compelled to pass on the complaints to the manufacturers and suggest remedies to overcome them. It was impossible to produce a cooker which would in every detail meet the requirements and idiosyncrasies of all supply engineers, and probably the I.M.E.A. was on right lines in its endeavour to evolve a standard type of cooker in two or more sizes which would command general approval. In Glasgow, as a result of three years' experience, they had practically decided on a standard size of oven and grill, while the boiling plate adopted could be replaced if and when improvements were carried out. There was no real call for a very small cooker for hiring purposes. Two boiling plates were usually necessary and for larger households a third, or even a fourth, boiling plate was required.

Improvements in design had been mainly on the lines of making the wiring more accessible in case of breakdown. The low temperature elements by which the modern oven was heated had a very long life, breakdown trouble being practically absent. The Glasgow model had a cooking space of 16 in. by 16 in. by 14 in., with side and bottom heating; in other parts of the country where bread baking was the custom, greater height might be necessary. The grill had all along been a satisfactory feature, and advancement had been mainly in the direction of making the elements more accessible and easy of renewal. It was possible to claim that the electric oven and grill were superior to any competitive apparatus. There were those who were content to await the advent of a trouble-proof electric boiling plate. They were told that electricity, which could provide heat for a mammoth steel furnace, could not boil a pint of milk satisfactorily. Surely there was sufficient ability with the electrical ranks to provide a boiling plate which would embody improvements suggested from time to time by experience. The E.D.A., the I.M.E.A., or the B.E.A.M.A., might offer a substantial money prize to the producer of a cooker boiling plate, which would at once be speedy and indestructible, one condition being a minimum efficiency of 50 to 60 per cent.

The gas industry had taken 30 years to produce what it described as the "perfect cooker"; it gained its knowledge, not only by workshop or laboratory tests, but by experience gained with apparatus under actual working conditions, and in the interim, in spite of the imperfect apparatus, it had succeeded in building up an enormous business. If we were content, as some advised, to do nothing pending the arrival of the perfect electric cooker, it would never arrive. It was the advent of the open type boiling plate which had made possible the recent development in the electric cooker business. In Glasgow a boiling plate had been produced having a 2,000-W loading in a small compass, which up till then had been considered impracticable. The former was made practically of solid fireclay to reduce the downward heat losses. This dispensed with reflectors or baffle plates. A later improvement was the alteration of the layout of the rotary switches to provide larger grill accommodation. To allow of the cooker being made "dead" when not in use, the fixing of a main switch at the bottom of the oven rather than on the wall was also embodied in the latest model. The development of cooking and other apparatus should be shared by all supply engineers, and there was an ever-increasing number of authorities prepared to invest in numbers of cookers, putting them in consumers' premises, thereby gaining first-hand experience which would be invaluable in improving the design of apparatus in the near future. The gas cooker was first put on the market not because it was cheaper to cook by gas than by the coal range, but mainly for reasons of convenience. Gas equipments of various kinds had been in use throughout the country for the past 10 or 20 years, yet, within the past year, probably assisted by the threat of electrical competition, a combination of the principal manufacturers had placed on the market a range of gas cookers claiming to possess advantages, which, if true, rendered 95 per cent. of existing gas appliances obsolete. Those electricity undertakings which had spent considerable sums on the purchase of cookers, and were liable to dread the possibility of this apparatus becoming obsolete, might surely find reassurance in that. Greenock, a comparatively small town, was spending £12,000 in an endeavour to bring the boiling tables of existing gas cookers in its area up-to-date.

Any trouble experienced by hiring authorities might safely be said to be confined to the boiling plate. The dread item "maintenance costs" could for practical purposes be ignored were it not for the susceptibility to abuse of the boiling plate. In the kettle they had a piece of apparatus with satisfactory efficiency, quick results and long life under fair working conditions. A kettle with an automatic cut-out device was being tried in Glasgow; this promised to eliminate the trouble of burning out. Mr. Hurry had said recently that many supply authorities were undecided whether the electric cooker was good enough to offer to the public. Scepticism on that point up till a few years ago was justified, as several bad attempts had been made. In an all-electric suburb of Glasgow, where an experiment had been provided by the enterprise of a private builder some ten years ago, probably the first of its kind in the country, the Department had in its own interest two years ago to replace the original electric cookers by up-to-date apparatus. This was part of the price paid by pioneers. But they now stood on firmer ground, and all undertakings should take up the business. The moment was opportune, as much of the experimental work had been done. Due to increased output, manufacturers were able to offer at a fairly moderate price, a reliable, tested article. From the supply authorities' point of view, the present price of the electric cooker was much too high. While a gas cooker cost about £4, the electric cooker cost £12 10s. An electric cooker might reasonably be expected to cost more than the gas cooker, but not three times as much, and a reduction in price was imperative. No supply authority could possibly go out for a tithe of the available cooking business with apparatus at the prices prevailing to-day. In Glasgow, for instance, they had at present on hire 1,400 cookers, involving a capital expenditure of over £20,000. If that figure were multiplied by five, as might easily be done within a couple of years if they wished, the capital involved became appalling. Electric fires had been considerably cheapened and there was at least one manufacturer whose output last year exceeded 40,000 fires. As a result they were now able to purchase electric fires as cheaply as gas fires, and, what was more important, purchase a fire which required no more maintenance (probably actually less) than a gas fire. The electric iron could also be bought to-day as cheaply as the gas equivalent, probably because manufacturers were turning these out by tens of thousands.

Why should this not be carried a step further and cookers be turned out by the thousand from a factory equipped for the mass production of electric cookers alone? So far as the speaker knew, no such factory existed. Electric cookers were treated by the majority of firms as a side line, and manufactured in small numbers in some corner of a factory or foundry. Further, probably no manufacturer employed a staff whose constant duty it was to endeavour to improve the product.

Obviously a limited luxury business could be done under existing conditions. Certain people could afford to have their houses wired, irrespective of cost, and probably they had already secured most of that business; numbers of people would have the electric cooker, regardless of the amount of hire charge, nay, though they had to purchase it; and the same held good with all types of electrical appliances. But if complete electric service was to have any meaning for the majority of the dwellers in residential areas, they must be able to have their houses wired cheaply, and having done so, see that no obstacles were placed in the way of complete equipment.

Supply authorities were at least attempting to meet their obligation by making cheap supplies of electricity available. They were daily, in greater measure, taking all reasonable steps, locally and nationally, to acquaint the public with the advantages of electric service in the home. The next move was to cheapen the price of the various appliances, especially cookers, wash boilers and vacuum cleaners.

In conclusion, the speaker said that he was not unmindful of the valuable, oft-times unremunerative, development work carried out within the past ten years by several manufacturers. It was due at least partially to their efforts, that the electric cooker business stood to-day in such a promising position. What he had said regarding the necessity for larger production and lower prices had been said because he realised that we were on the threshold of immense developments, which could best be hastened by action on the lines indicated.

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**Registration of Electrical Undertakings in Sweden.**—The Swedish Board of Trade has proposed to the Government that an increase be made in the stamp taxes for the registration of electrical undertakings. In the opinion of the board, it is only reasonable that the owners of private installations, who rely upon the State department for an examination with the object of thereby securing a special advantage of a legal nature, should contribute towards the expenses incurred by the State in this respect. The Board therefore proposes the imposition of definite charges per mile of high- and low-pressure lines and also according to the capacity of sub-stations.

# Electrical Development in New Zealand.

## Some Impressions produced by a recent Visit.

By V. FERRANTI.

(*Concluded from page* 488.)

In 1923 there were 63 generating stations in New Zealand, half of which depended upon water power; their average installed capacity was 915 kW, aggregating 57,589 kW, and the maximum load was 54,502 kW. There were 106,790 consumers, and the total output (generated) was 195,600,000 kWh, the annual load factor being 41.0 per cent. The total capital outlay (including distribution, but excluding special tramway power stations) was £6,408,492, averaging £111 per kW installed (water, £148; steam, £94; gas, £177; oil, £94). The average working cost per kWh sold was 0.97d. (water, 0.57d; steam, 2.01d.; gas, 4.02d.; oil, 3.08d.), and the total cost 1.71d. stalled (water, £148; steam, £94; gas, £177; oil, £94). The revenue per kWh sold was 1.91d., and per kW £24.2, the net profit being £109,000.

The annual load factors for the year were: Water power, 48.6 per cent.; steam, 32.4 per cent.; total output, 41 per cent. The load through the day, from 8 a.m. to 5 p.m., is very uniform; in summer there is a drop at 5 p.m. before the lighting load arrives at 7 p.m. In winter the peak occurs between 4 and 5 p.m., due to the overlapping of lighting and power and tramway loads. It is largely with the object of reducing the overlapping peak that the adoption of a standard time—twelve instead of eleven and a-half hours ahead of Greenwich mean time—has been proposed.

The registration of wiremen has been under consideration for some years, and a Bill has been drawn up to bring the qualification and registration conditions of wiremen to a uniform standard throughout the Dominion.

The hydro-electric development is so rapid that it is found difficult to get the trained staff necessary at the salaries available.

### Manawatu-Oroua Electric Power Board.

*Extracts from a circular distributed amongst the potential consumers.*

In most of the electrical undertakings of New Zealand nearly 100 per cent. of the possible consumers are ultimately secured, and delay in bringing about this measure of saturation is generally due to consumers being unable to spend money on wiring. The Board, realising this, offers financial assistance to get all premises wired by the time the supply is available; under this scheme consumers' installations are often ready before the supply, but they do not pay for the equipment until the supply is connected. They then pay the whole cost, or 25 per cent. deposit and the balance over three years. The Board will carry out installation work in blocks of a considerable number of houses at a time, against tender, so reducing the cost of wiring to the consumer's benefit. Motors for farmers and others are also bought under contract in large quantities, the user being given the benefit.

The costs of installations vary from 35s. to 37s. 6d. a point, including lamp and plain shade; the cost of wiring, with control panel for a 2-h.p. motor, is about £8. Two-h.p. motors for milking plants are purchased by the hundred and sold at about £16 each, including starting switch, or £25 (average), including all wiring but no countershaft.

The first chain of line to consumer's property is provided free, but beyond this distance at a cost, for lighting only, of about 5s. 9d. per chain (two wires); motor and lighting four wires, about 11s. 6d. per chain, or in triple braided cable, 7s. 6d. and 16s. 9d. per chain respectively. Poles are provided every 2½ chains complete at £2 4s. 3d. per pole, erection extra, and fitting of arms and stringing wires at about 5s. per chain run of four wires; the prices are divided, as many consumers do some of the work themselves.

The tariff charges are:—Light, at 8d. per unit, minimum 5s. per month. Heating and ironing at 3½d. per unit, minimum 5s. per month. Residence rate at Board's option, single meter for all purposes, first 9 units a month 8d., balance 3½d., minimum 5s. per month. Milking plant motors, 2 h.p., £10 a year plus 2½d. per unit; 3 h.p., £15 a year, plus 2½ per unit.

The consumption for lighting of milking sheds is charged through the motor meter. The milking rate is said to be the cheapest given by any Power Board in New Zealand, and it works out roughly at about 10s. per cow per annum.

Water heating, £5 10s. per annum for 600-watt heater if on change-over switch from motor, &c.; otherwise £12 per kilowatt.

Motors for intermittent use (such as shearing sheds, &c.), 4½d. per unit. Minimum charge 25s. per year.

Motors for industrial uses, 3½d. per unit for the first 100 units a month, then 3d. a unit up to 200 units per month, and 2d. a unit for the balance. Minimum charge, 2s. 6d. per horse-power per month.

Electric ranges for cooking, 1½d. per unit, with a minimum charge of £2 a quarter per 2-kW range and a minimum charge of £3 a quarter per 3-kW range.

Large consumers, £3 per kVA per quarter of recorded demand, plus ½d. per unit, with a minimum of £180 per annum. For consumers who will guarantee to take over £500 worth of energy per annum a special rate will be issued. In all cases the units used will be charged for at 1d. per unit extra, on the previous figures, but this amount will be allowed as discount if the account is paid by the discount day.

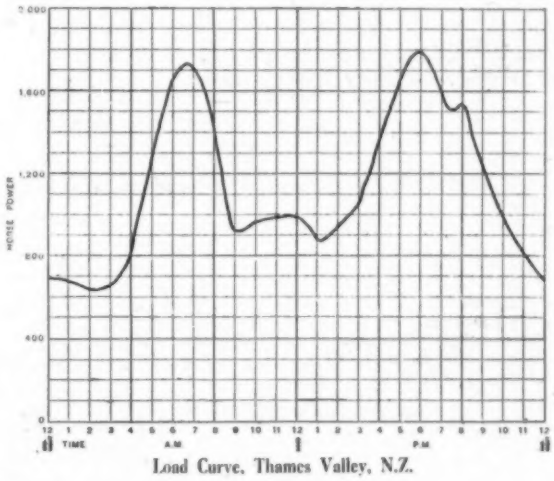
The Power Board Scheme belongs to the ratepayers, who are collectively responsible for the loan charges and so help themselves by prompt application for supply. At the date of issue of the circular about 90 per cent. of the residents had signed on in the districts canvassed. If expenses are not met the Board has power to make a rate on all property within ten chains of an electric line, but allows any person who is a consumer, a supply of electricity free up to the amount of the rate.

This paragraph covers an important and interesting principle, which probably acts as a most powerful canvasser. The community having decided to have a Power Board, authorised borrowing, and committed itself to meet charges, can turn the burden of those charges, if any, on to members of the community who could use electricity and do not—a procedure which, although perhaps appearing drastic to us, probably prevents in the most effective way any losses or charges accruing to anybody.

### Thames Valley Electric Power Board.

*Extracts from a useful leaflet—daily load curve.*

The early morning peak seen on the diagram is produced by milking machines. There is a popular description of the curve showing that the Board buys in bulk and pays on the peaks; it also shows how the consumer may keep the peaks down relatively to consumption. The leaflet invites the co-operation of the consumer by asking him to use certain appliances between certain hours and so help the Board and himself, and reminds him strongly that the Electric Power Board is really his business and he should help to make it successful.




Load Curve, Thames Valley, N.Z.

The rates charged for town areas are:—

Lighting, 9d. per unit. Heating, cooking and motors, 3½d. per unit for the first 100 units per month, 2½d. for the next 100 units per month, then 2d. up to 5,000 units, 1½d. to 10,000 units, 1¼d. to 15,000 units, 1d. to 20,000 units, 0.9d. to 25,000 units. A minimum charge per consumer of 5s. per month is made. For power the minimum charge is 22s. 6d. per quarter per horse-power of installed capacity. Special terms are arranged for consumers working on certain restricted hours.

The rates charged for country areas are:—

Lighting, 32-candle power lamps, at 12s. per lamp per annum; 50-candle power lamps, at 18s. per lamp per annum. Lamps in bedrooms, closets, milksheds, and stables, are charged for at half these rates, and at least one lamp is charged for in each room in the house.

Heating and cooking, one 600-watt heating point for electric iron, grill, toaster, kettle, &c., at £3 per annum; one 1-kW heating point, at £4 10s. per annum; one 2-kW oven, at £8 per annum; one 2-kW oven with 1-kW water heater on change-over switch, at £14 per annum; and one 1-kW radiator for use in any room, at £7 10s. per annum. The minimum charge per consumer is 15s. per quarter. These flat-rate charges are given only upon the understanding that economical use is made of the supply. The Board reserves the right to

charge full rates for all services, or to cut off the supply in case of abuse.

Power, one 2-h.p. motor for milking machine only, at £21 per annum; one 2-h.p. motor for milking machine and for general work about the farm, at £25 per annum; one 2-h.p. motor for milking machine with change-over switch for water-heating 1-kW and 2-kW, at from £27 to £33 per annum; one 2-h.p. motor for milking machine, general power purposes and water heating, at from £31 to £37 per annum; and motors for other purposes at £8 per h.p. per annum. Special charges are made to suit exceptional cases. For 2-h.p. motors for milking, the minimum yearly charge is £15. For every 1 lb. of butter-fat above 5,000 lb. produced per annum an extra charge of one-third of a penny per lb. is made. A 1-h.p. motor may be used for small herds for which the minimum yearly charge is £10 10s. up to 3,500 lb. of butter-fat. With this motor an additional charge of 0.72 of a penny per lb. of butter-fat is made for all above 3,500 lb. up to 7,000 lb. Above 7,000 lb. the same rate applies as with the 2-h.p. motor, namely, one-third of a penny per lb.

### The Dannevirke Electric Power Board.

*Extracts from descriptive booklet.*

This is a co-operative undertaking, every ratepayer being a shareholder; the Board is elected by the ratepayers, and is only required to pay its way. A great effort is being made for the undertaking to pay from the commencement. The Board buys in bulk on a maximum demand system which is explained to its public, and an attempt is made to secure a diversified load and keep down the average cost.

The dairy milking load is on from 5 a.m. to 7 a.m., the dairy factory load till about 3 p.m., when the milking load comes on again for afternoon. The town industries load is on from about 8 a.m. till 5 p.m., the lighting load generally later. A general diversity of about 4½, brings a revenue of £36 per kVA a year. Charges to the consumers vary from £6 to £10 per kVA per year. A special rate of ¾d. per unit for freezing between 9 p.m. and 5 a.m. is charged, and for hot water for scalding in farms if power is taken after 9 p.m. a low rate of charge is made.

The whole district is surveyed at the start, and every farm, house, and factory is plotted with the possible load. Financial assistance is given on installation and wiring; the Board's inspector estimates for the work, the consumer deposits 5 per cent. and undertakes to pay another 15 per cent. when the supply is available, and the balance in 24 monthly instalments with interest at 7 per cent. based on monthly balance, and a further 2½ per cent. is charged for supervision. The installation work is carried out in blocks, and in the Wellington province alone 20,000 houses and farms are to be wired within a year. The Board seems to hold a threat over the contractors that it will do the wiring itself unless the quality, price, and speed are reasonable.

Charges, Domestic Rate (Rate A), minimum charge of 5s. per month in boroughs and 7s. in country areas. Sliding scale from 8d. for each kWh consumed down to 4d., depending on the connected load. For 12 rooms and over, two meters may be insisted on. Electric iron and heating appliances consuming not more than 1,000 watts are exempt from the connected-load rate when used on lighting installations.

Commercial Light Rate (Rate A.1), minimum charge 5s. per month and 7d. per unit for all units consumed.

General Power and Heating Rate (Rate B), minimum charge 5s. per month per h.p. of connected motor load, or 5s. per month per kW of heating load and from 3d. to 1½d. per kWh. From 9 p.m. to 5 a.m., where the Board is put to no extra expense for transformer or line capacity, the charge is ¾d. per kWh, with a minimum charge of 2s. 6d. per month per kW of heating load or h.p. of motor load. The consumer has to install and maintain an approved time switch; but the Board may do this and charge the consumer a nominal fee.

Milking Rate (Rate C), £5 per year per h.p. of connected load plus 2½d. to 1½d. per kWh.

*Milking.*—A 2-h.p. motor is usually employed for any shed and will run a six-cow plant, separate, and pump water at the same time. Two-h.p. motors are used for milking over 100 cows satisfactorily, 1½-h.p. motors up to 50, and 1-h.p. motors up to 30. Consumers are advised to use motors as small as possible for milking.

*Dannevirke Electric Power Board's Milking Rates.*—£5 per year per h.p. of connected load, plus from 2½d. to 1½d. per kWh. The low rate of 1½d. per unit will allow for household cooking, hot-water heating, and other power purposes, if the switches are arranged so that none of these extra services can be used while the motor is being run for milking. The connected load of the largest appliance only is considered under these circumstances.

Scalding water with alternative switching to the milking, lighting, or cooking, £6 per year for 1,000-watt element, which will heat 20 gallons from 50 degrees to 180 degrees in 8 hours.

Some typical milking costs are shown in the following table:—

| Farm. | Cows. | Units. | Size of Motor. | Cost per year. |
|---|---|---|---|---|
| A | 75 | 1,801 | 2 h.p. | £28 15s. 2d. |
| B | 50 | 1,001 | 2 h.p. | £20 8s. 6d. |
| C | 34 | 706 | 1½ h.p. | £14 17s. 1d. |
| D | 28 | 502 | 1 h.p. | £10 4s. 7d. |

Note.—If the farm "C" elected to use a 2-h.p. motor, the bill would be £2 10s. greater.

If proper care is used the cost will be of following order:—

For 100 cows, using 2 h.p. ... £29 to £31 per year
For 75 cows, using 2 h.p. ... £27 to £29 ,,
For 50 cows, using 2 h.p. ... £21 to £23 ,,
For 30 cows, using 1½ h.p. ... £14 to £16 ,,
For 20 cows, using 1 h.p. ... £10 to £12 ,,

It is evident from comments in the book that there has been waste of power in milking due to bad countershafting, motors too large, &c. The book closes with many simple examples of the meaning of technical terms and the cost of electrical appliances.

# The Institute of Metals.

## Summary of Selected Papers

Amongst the papers presented at the annual general meeting of the Institute of Metals, on March 11th and 12th, several were of interest in that they dealt with the properties of metals employed in the electrical industry; they are briefly summarised below:—

### Aluminium Alloy Castings.

A method of improving the properties of aluminium alloy castings was described by Mr. S. L. Archbutt, F.I.C. (of the National Physical Laboratory). The experiments and results obtained from them are regarded as indicating the possibilities of a method of treating aluminium and certain of its alloys which serves to eliminate, at all events, a considerable proportion of dissolved gas and thus reduces unsoundness and, to a considerable extent, removes pin-holing. The process suggested consists in allowing the molten alloy or metal to cool slowly in the crucible in the furnace until it has just completely solidified; it is then remelted and may be carefully stirred, raised to the pouring temperature, and cast. Ingotting the metal is not satisfactory, as the ingots cool too quickly, and during remelting are too much exposed to the furnace gases. In a later experiment the passage of an inert gas through the melt during slow cooling and solidification has been found to improve still further the soundness of resulting sand-cast bars. Slightly anomalous results have been obtained in some cases, and it is not yet clear how far the method is of value in other alloys, whether consisting mainly of aluminium or of other metals. It is evident that much further investigation is required; meanwhile, simultaneously and independently Prof. C. A. Edwards and Mr. W. E. Prytherch, of Swansea, working on the effect of gases in copper (for the British Non-Ferrous Metals Research Association) have discovered a similar effect obtained by solidification in the crucible in the case of pure copper.

### Commercial Copper Rod.

Comparative tests on some varieties of commercial copper rod were outlined by Mr. T. G. Bamford, M.Sc. The primary object of the research was to compare the properties of certain distinctive varieties of commercial copper, with a view to ascertaining their relative durability under conditions which they would meet in service, particularly as constructional parts of locomotive fireboxes. Three deoxidised and two "tough-pitch" coppers were tested. Of the former, the first contained 0.31 per cent., and the second 0.53 per cent. of arsenic, while the third contained 1.5 per cent. of nickel and but a trace only of arsenic. Of the "tough-pitch" copper one contained a trace, while the other contained 0.45 per cent. of arsenic. The phosphorus in commercial copper which has been deoxidised with this element does not impair the mechanical properties of the metal. Three lots, containing up to 0.2 per cent. of phosphorus, were extremely strong, quite ductile, and more resistant to alternating stresses than "tough-pitch" varieties free from phosphorus. Deoxidised low arsenical, high arsenical, and 1.5 per cent. nickel copper containing up to 0.014 per cent. of oxygen withstand severe gassing treatment, which would ruin "tough-pitch" metal. Deoxidised copper containing 1.5 per cent. of nickel is more resistive to harmful influences arising from severe heating in either reducing or oxidising atmospheres than are either "tough-pitch" (arsenical or non-arsenical) or deoxidised arsenical coppers. Actually, the tensile strength of this nickel-copper is vastly improved, its hardness greatly increased, no brittleness is developed, and it preserves a high ductility after severe gassing treatment. Nickel-copper containing 1.5 per cent. metal oxidises less rapidly than any other variety tested. The "tough-pitch" and the deoxidised varieties, not containing nickel, oxidise approximately to the same extent, but when the "tough-pitch" varieties scale the oxide pene-

trates into the metal—more particularly so in the case of non-arsenical "tough-pitch" copper, on which a very rigidly adherent scale is formed. It follows that "tough-pitch," non-arsenical copper will give most trouble in hot-working operations where it is desired to avoid entanglement of scale in the metal. The resistance which 1.5 per cent. nickel-copper possesses to gassing, as well as its augmented hardness and strength resulting from high-temperature treatment, render it very suitable for engineering, and particularly for locomotive parts.

### Electrical Resistivity of Copper.

A note on the effects of certain elements on the electrical resistivity of copper was presented by Mr. A. L. Norbury, M.Sc., in the first part of which some new data are given for the electrical resistivities of certain alloys of copper containing low percentages of each of the following added elements in solid solution: Aluminium, silicon, manganese, nickel, zinc, silver, and tin. From his results and those obtained by previous investigators, values for the "increase in the electrical resistivity of copper due to the presence in solid solution of 1.0 atomic per cent. added element" have been calculated for each of the added elements. The results so obtained show that the "atomic effects" are small for elements like silver and gold, which are in the same group as copper in the periodic table, and are progressively larger as the added elements are further away from copper in the table. It is suggested, therefore, that the "atomic effects" are large or small according as the "affinity" between atoms of solvent and solute is large or small.

### Abrasion of Metals.

Some experiments on the abrasion of metals were described by Prof. Kotaro Honda, Sc.D., and Prof. Ryonosuke Yamada. With respect to soft metals and carbon steels the amount of wear is proportional to the frictional horse-power, provided that the coefficient of friction is constant. Under a constant frictional horse-power the amount of wear increases with the coefficient of friction. The effect of the velocity of abrasion on the amount of wear was negligibly small in the range of velocity investigated.

### Localised Corrosion.

Surface abrasion as a potential cause of localised corrosion was the subject dealt with by Mr. Ulick R. Evans, M.A. Previous work has indicated that most cases of serious corrosion are of an electrochemical character; for electrochemical action usually gives rise to soluble primary corrosion products, whilst direct chemical oxidation would generally produce an insoluble body *in situ* on the metallic surface, which would tend to obstruct further attack. Bengough indicated that local abrasion, by causing removal of the obstructive film, may allow local attack, whilst von Wurstemberger suggested that very severe corrosion may be occasioned by electric currents flowing between the bare abraded portion and the still encrusted area.

An experimental investigation has been made regarding the existence of these currents. Sometimes they flow in such a direction as to localise corrosion on the small abraded portion, sometimes in the contrary direction, but they are generally transitors, dying away soon after abrasion ceases. Moreover, the abrasion required to produce these currents must, in most cases, be sufficient to damage the metal by mechanical erosion also. In the case of the corrosion of zinc by hydrochloric acid, the wiping away of the black scum of residual impurities (lead, &c.) actually diminishes the rate of attack; the impurities, if allowed to accumulate, act as the cathodic members of the corrosion-couples and facilitate the liberation of hydrogen. Vernon's statement that commercial (impure) zinc is attacked more slowly than some grades of much purer zinc is, however, confirmed; probably "homophase" impurities (in solid solution) behave in the opposite mode to "heterophase" impurities (present as a separate phase).

### Grain-size and Hardness.

The effect of grain-size upon hardness and annealing temperature was explained by Messrs. H. T. Angus, M.Sc., and P. F. Summers, A.R.S.M., who showed that the grain-size of a metal just before rolling considerably affects its hardness when annealed after rolling at temperatures up to the recrystallisation temperature. Many heavily worked metals increase in hardness on annealing for a short time at relatively low temperatures, and this property is shown to depend, among other things, upon the grain-size that existed at the time of rolling. A coarse grain-size increases this rise in hardness and the range of temperature over which it extends, whereas with a fine grain-size softening may commence at much lower temperatures. This effect was noted in both pure copper and bronze containing 4.5 per cent. of tin. It was also observed that the recrystallisation temperature of copper is higher in the coarse-grained metal than in the fine-grained, in which almost complete softening occurs before signs of recrystallisation appear; while, in the coarse-grained copper, the same degree of softening is only reached when complete recrystallisation occurs.

The relation between grain-size and hardness for copper and bronze shows that as the grain-size increases after recrystallisation the hardness decreases correspondingly. It was found by calculating the area of grain boundary per cubic millimetre of metal from the grain-size, and plotting against hardness, that a straight line was obtained, indicating that the hardness varies directly with the area of grain boundary per unit volume of metal.

# The Faraday Society.

## Electrolytic Deposition and Corrosion of Metals.

A group of papers on various aspects of electrolysis were read at a meeting held on February 16th in the rooms of the Chemical Society. We give a brief account of those of direct technical interest.

### Superposed Alternating Current in Gold Deposition.

Prof. A. J. Allmand and Dr. U. S. Puri described the results of a research on the effect of superposed alternating current on the anodic solution of gold in hydrochloric acid. In the well-known Wohlwill gold refining process as now practised, an alternating current of rather greater r.m.s. value than the direct current is superposed on the latter, resulting in an asymmetrical alternating current with strong anodic and weak cathodic pulses. The effect of this procedure is to permit of the employment of a much higher current density than when a direct current only is used, for in the latter case a layer of silver chloride forms on the anode, interfering with the solution of the gold. The effect of the alternating current is remarkable. In the case of a bullion with 10 per cent. of silver the current density can be increased from 7.5 to 12.5 amps./sq. din., the anode remaining quite clear of deposit and coherent cathodic deposits being obtained. The bath voltage also is reduced. Increasing the strength of the alternating current enables a 20 per cent. bullion to be refined successfully. The present paper gives the results of a systematic study of the behaviour of pure gold anodes under various conditions, using both d.c. and a.c., and as such should be fruitful in leading to further improvements in the Wohlwill process.

Working with direct current only it was found that the "limiting" current density—that at which chlorine evolution commenced—was proportional to the acid concentration of the solution and it increased with increasing temperature, although the anode potentials were lower, the higher the temperature. There is a sudden cessation of anodic gold solution at the "limiting" current density, and this is attributed to the formation of an oxygen-gold alloy on the anode surface, produced by discharge of hydroxyl ions, the rate of deposition of which will be roughly inversely proportional to the HCl concentration. Alternating currents of frequencies from 20 to 400 were then superposed on the direct current, again using different acid concentrations and varying the temperature. It was found that (*a*) at constant direct current density, an increase in the ratio a.c.: d.c. progressively lowers the solution potential of the gold; (*b*) an increase in the same ratio increases the limiting current density for gold solution; (*c*) there is but little difference between the various potential values at which gold solution ceases; (*d*) an increase in the ratio a.c.: d.c. lowers the polarisation required for initial steady chlorine evolution.

Defining the "activity" of gold as the limiting direct current density to which an anode can be subjected without passivity setting in, this was found to increase considerably with diminishing frequency from 400 to 60 and its percentage increased with HCl concentration, although somewhat less rapidly. The potential of the anode at the limiting current density became lower (less positive) the greater the a.c.: d.c. ratio, and the lower the acid concentration. For the theory of these effects reference must be made to the paper.

### The Electrolytic Deposition of Cadmium and other Metals on Aluminium.

Prof. C. H. Desch and Mrs. E. M. Vellan presented a paper on this subject. The research described arose out of an attempt to protect aluminium and its alloys against atmospheric corrosion. The difficulty in the cadmium process arises from the tendency of deposits of that metal to blister or flake, but the authors have succeeded in preventing that trouble. As in most plating processes a perfectly clear cathode surface is an essential condition for success. For the present purpose this is obtained by sandblasting the aluminium and then either coppering from a hot cyanide bath and again sandblasting, or else cleaning electrolytically in a ferrous chloride bath and then sandblasting. The best solution to use for the cadmium plating was found to be an ammoniacal solution of cadmium sulphate containing peptone as a colloidal addition agent. For further particulars of making and working the solution reference must be made to the paper. Nickel can readily be plated on the cadmium and for some purposes it will probably be found desirable to use it. A comparison with other metallic coatings shows a great superiority in favour of cadmium over other metals, such as nickel or copper, or even zinc, as a means

of protecting aluminium against atmospheric corrosion and, moreover, the deposit has a pleasing appearance and a good colour. The authors have also succeeded in plating iron and nickel on aluminium.

In the course of the discussion it was pointed out that peptone is also found to be a valuable addition agent in the case of copper deposition, where it greatly improves the physical properties of the copper and does not contaminate the solution as is the case with many other organic colloids often recommended.

### The Electrolytic Corrosion of Ferrous Metals.

There is at present no satisfactory method of predetermining by laboratory tests the probable corrosion of iron and its alloys under atmospheric exposure. The usual method of immersion in acid or other solutions is obviously unsatisfactory. Not only do the chemical reactions differ more or less from those which occur in atmospheric corrosion, but the physical conditions are even less comparable, and these are an important factor in determining the course of corrosive action.

Professor W. M. Thornton and Dr. J. A. Harle have tackled the problem in a straightforward manner by making the specimen to be tested the anode in a cell containing slightly acidulated water in order to obtain conditions of exposure to moist oxygen under perfect control. The advantage of this method of "forced electrolytic corrosion," arising from the action of the oxygen liberated at the anode, is the rapidity with which tests may be made and the freedom of the specimen from the retarding influence of surface products. The latter advantage is, however, a two-fold weapon, as was pointed out in the discussion, for in practice such surface products do actually remain on the metal and modify the atmospheric effects. Nevertheless, for comparative purposes the method should prove an extremely useful one and the results already obtained are of great interest. The conclusion reached is that not only have pure metals definite rates of corrosion according to Faraday's law of electrolysis, but that every ferrous alloy examined has a specific rate of electrolytic corrosion, of so definite a value under known conditions that the alloy can be identified with certainty by means of this corrodibility.

In order to render the results comparative, the authors introduce a quantity which they term "corrosion coefficient," which is simply the loss of mass of the metal or alloy, in grammes divided by the quantity of electricity required to produce that loss, in ampere-hours. For most of the alloys tested this corrosion coefficient was found to be constant over a wide range of ampere-hour values and its value is given for various ferrous metals in the following table:—

| Specimen. | | Corrosion Coefficient. | Description. |
|---|---|---|---|
| 1.— | V | 1·112 | Era, Cr Ni. |
| | K | 1·104 | Hecla 3½ Ni. |
| | U | 1·100 | Era, C Mn. |
| | G | 1·088 | Mild steel 5 per cent. Cu. |
| | X | 1·038 | Resista Mn Ni. |
| 2.— | H | 1·068 | Mild steel, 2 per cent. Cu. |
| | W | 1·064 | Era, 3C, 1·3 Mn. |
| | D | 1·056 | Steel 0·4 per cent. C. |
| | FeO | 1·04 | — |
| 3.— | N | 0·944 | Wrought iron. |
| | P | 0·912 | Swedish charcoal iron. |
| | B | 0·901 | Mild steel, low Mn high S and P. |
| 4.— | M | 0·784 | (Armco iron) pure iron. |
| | $Fe_3O_4$ | 0·780 | — |
| | $Fe_2O_3$ | 0·695 | — |
| 5.— | L | 0·20 | 36 per cent. Ni steel. |
| 6.— | T | 0·118 | Galahad cast. |
| | S | 0·080 | ,, forged, high carbon. |
| | J | 0·072 | ,, forged. |

The division into groups is well marked. Groups 1 and 2 corrode more easily than pure iron even when the latter is divalent; Group 4 is pure iron oxidising apparently to $Fe_3O_4$. In Group 5 the high nickel content reduces the corrosion to nearly one-fifth of that of wrought iron and the rustless steels of Group 6 have a mean corrosion of one-thirteenth of that of Groups 1 and 2.

While the method does not imitate practical conditions of exposure, it is reliable and capable of repetition to a high degree of accuracy, and as such satisfies the first requirement of a standard corrosion test.

# New Electrical Devices, Fittings, and Plant.

***Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.***

### The Harmall Bending Block.

What should be an extremely useful device is marketed by the Harmall Bending Block Vice Co., 174, Sixth Avenue, Manor Park, London, E.12. Type B vice is illustrated in fig. 1, while an example of its use is shown in fig. 2. The holes in the base, combined with the slots in the blocks, enable the latter to be placed so that any desired position can be obtained, the aim being to facilitate the bending by hand of rods, bars and pipes in a simple, accurate, neat and easy manner. With the device one or more bends or sets of different size and shape can be made in the same material by placing or moving the blocks to the required position, thus simplifying complicated and awkward bending jobs. It should prove an indispensable tool in electrical, mechanical, and other engineering work for bending and setting round, square, and flat brass, copper, aluminium, iron and steel rods, angle iron, pipes, and tubes; also it can be used as an ordinary vice for holding taper or irregular work, &c.

The weight of the type illustrated is 43 lb., the height and width of the jaw face being 2 by 4½ in.

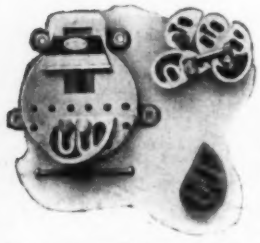


Fig. 1.—Harmall Bending Block Vice.

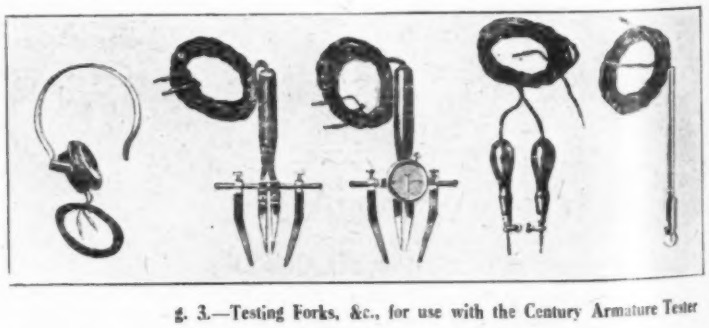
Fig. 2.—Example of Work Done.

### The "Procophone."

This instrument has been placed on the market as an addition to any ordinary desk telephone, and might be useful under certain conditions; it is not an attachment, and is claimed by the Hendon Electric Lamp Co. to be fully permissible under the Post Office telephone regulations. Instead of placing the telephone receiver to the ear, one stands it on the "Procophone," which rests on the desk, and by means of a forked flexible tube, the sound is directed into both ears at once. The device is somewhat similar to a medical stethoscope; it eliminates inside and outside noises, and allows the user to have both hands free so that he can write or handle papers, &c., whilst talking or listening.

### New Armature Tester.

From *Electric Traction* we learn of a new armature tester put on the market by the Century Electrical Co. This tester consists of an ordinary resistance testing box with specially designed connecting forks enabling the commutator bars to be connected with ease during testing. The forks, which are constructed for use either with a detector or a telephone receiver, are shown in fig. 3. It will be noticed that the inner fingers, for use in testing between adjacent commutator bars, can be used at the same time as the outer fingers are being used in testing between other pairs of bars with the fingers suitably placed. A search lamp, which can be inserted behind the commutator segments, is also provided with the tester. In using this tester considerable time should be saved in connecting up, &c., for testing.



g. 3.—Testing Forks, &c., for use with the Century Armature Tester

### Starting Panel for Small Motors.

The use of the fully protected starting panel, *i.e.*, one including a mistake-proof starter interlocked with a d.p. no-volt and overload release circuit breaker and an isolating switch interlocked with the doors of the case, for small electric

motors, is generally prohibited by the cost, which is usually somewhere in the region of that of the motor itself. In order to overcome this difficulty and to discourage the unsatisfactory practice of employing separate starters, switches and fuses, MESSRS. BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester, have placed upon the market a midget type of control panel intended for use with small motors up to about 10 h.p. This panel, which can be produced within reasonable limits of size and price, is shown in fig. 4, with the main and inner case doors open. The panel includes an ordinary faceplate starter, and can be provided with or without a speed controller.

The motor protection consists, in addition to the no-volt release of the starter, of a magnetic overload trip on one pole

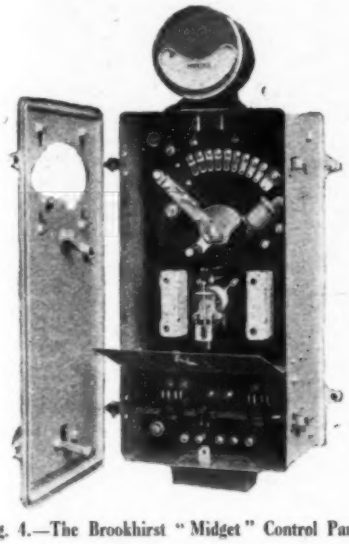


Fig. 4.—The Brookhirst "Midget" Control Panel.

only, with the addition of a fuse on each pole. For the protection of the operator, the main D.P. switch is enclosed in an inner chamber, and is interlocked with the main door of the case so that it is impossible to open the door while the switch is "on" or close the switch while the door is open.

The design is really a modification of some of the larger types of Brookhirst hand-operated starter panels described in these columns on January 27th, 1922, the essential differences being the omission of the "slow motion" action of the starter, and the isolating switch. The starter is also of the non-inching type, but provision is made for remote stopping by means of a push button device which short-circuits the no-volt coil.

### "Ebolite" Press-Button Switches.

The switch illustrated in fig. 5 is typical of a range of small press-button switches introduced by MESSRS. S. G. LEACH & CO., LTD., 26-30, Artillery Lane, E.C. The bodies of these switches are of "Ebolite," an insulating composition which is practically unbreakable, non-hygroscopic, and acid proof, and has a high polish. The mechanism consists of a simple rocking arm operated by two push buttons, one of which is provided with a white spot to show the position of the switch—when

Fig. 5.—An "Ebolite" Press-Button Switch.

this is depressed the switch is on. The contracts are of h.c. copper and the actuating spring is of phosphor-bronze. As the moulding is in one piece there is no possibility of losing the cover or of receiving a shock once the switch is mounted on the special wood block which is provided. Furthermore, the press buttons are permanently attached to the contact arm and cannot come out. The switches are rated at 5-A for 240-V circuits. They can be obtained in the form illustrated, combined with a plug, or in a suspension type (similar to a "pear" switch).

# The National Register of Electrical Installation Contractors.

### Annual Meeting.

THE annual meeting of the National Register was held on March 27th, at the Institution of Electrical Engineers.

Mr. P. V. HUNTER, C.B.E., took the chair, and after the usual preliminaries, read the report of the Executive Committee, the main points in which are brought out in a leaderette in this issue. The report also showed that the cost of conducting the register to the first year worked out at £2 5s. for each certificate granted. The six municipalities which have taken official action in support of the register by issuing notifications to the effect that tenders from registered contractors only will be considered, are Manchester, Hull, Wolverhampton, Bristol, Preston, and Croydon. The chairman mentioned that since the report was printed, Newport Corporation had been added to the list.

Inquiries were received as to the constitution of the Board and its methods of working, from Calcutta, Bombay, Shanghai, Melbourne, New York, and San Francisco.

The Executive approved of an illuminated sign manufactured by the K.F.M. Manufacturing Co., Ltd., and arrangements were made for the sales to be made through the General Electric Co., Ltd.

The report and accounts were adopted, and the retiring members of the Registration Board were re-elected, with the exception of Lt.-Col. W. A. Vignoles, whose place was taken by Mr. C. H. Smythe. The latter gentleman was also appointed to the seat on the Executive Committee rendered vacant by Lt.-Col. Vignoles's retirement. Col. Crompton was unanimously elected to the Board as a nominee of the I.E.B. in the place of the late Mr. C. H. Wordingham, and Messrs. P. V. Hunter and A. H. Dykes were appointed chairman and vice-chairman, respectively, for the current year.

The standing order relating to the appointment of the Executive Committee was amended so that a member of the Committee need not be representative of the same interests as those by which he was appointed to the Registration Board.

The next matter discussed was the appointment of a treasurer. Messrs. Rawlings, Dykes and Cash were in favour of this, but Mr. F. W. Purse considered that it was an unnecessary measure. Eventually it was decided to appoint an honorary treasurer, and Mr. W. R. Rawlings was selected.

The meeting then considered the question of inviting registered contractors, who were not members of any electrical trade organisation, to appoint representatives on the Registration Board. In introducing the matter, the Chairman said that this had been the original intention. Most of the members belonged to trade organisations, but about a quarter of them did not, and he thought that they should be represented. Mr. Rawlings pointed out the difficulty of obtaining really representative members to undertake the task, but he thought that a representative might be put forward on his merits. Mr. Cash said that although the matter might be complicated, it would be possible to circularise "unattached" members for their views and nominations. Mr. Shaw thought that these members might be asked if they were satisfied with the existing arrangements or to put forward suggestions. Mr. Purse thought that the appointments would necessitate the alteration of the articles of association, and Mr. Dykes said that in view of that possibility it would perhaps be better to postpone the matter for a time. Subsequently it was decided that the "unattached" members should be circularised with a view to their appointing representatives to the Board, if the articles of association permitted this. It was understood that legal advice would be taken on the point.

Messrs. Price, Waterhouse & Co. were re-appointed auditors.

That concluded the ordinary business of the meeting, and Mr. Purse then raised the subject of criticisms of the Board. He asked if any member had any specific complaint to which attention should be paid. Mr. Robertson said that the principal complaint from Scottish applicants for registration was the delay which occurred in settling their cases and the number of unnecessary questions which were asked. The Chairman replied that the Executive Committee was bound to proceed cautiously and to make full inquiry. He considered that all of the questions put to applicants were necessary to make sure that their status was such as to render them eligible. Once a contractor was registered it would be a difficult matter to refuse re-registration.

Statements to the same effect were made by Mr. Cash, who replied on behalf of himself and Mr. Purse (the Scrutinising Committee) to a vote of thanks.

The meeting tacitly agreed that it was not necessary for the Board to meet more than once a year, and the proceedings terminated with a vote of thanks to the Chairman.

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**German Wind Power Experiments.**—An agreement has been arranged between the city of Berlin and the Flettner Wind-power Co. whereby the city will loan land on the Kaiserdam to the company for the erection of a wind-power experimental station. Experiments on a large scale will be commenced this month to generate electricity by wind power.

# Correspondence.

***Correspondents should forward their communications at the earliest possible moment.*** *No letter can be published unless we have the writer's name and address in our possession.*

### Radiation from Broadcasting Stations.

It would be interesting to know the source from which the technical and other Press obtained the description of the equipment of the new "2 LO" station. All the reports are wonderfully similar, and all give the information that 3 kW is *radiated from the aerial.*

The italics are mine, and particularly would I stress the word "radiated" since, of course, 3 kW represents a very large amount of power to be radiated, and it is doubtful if this is even the *input* to the aerial. Of the input to the aerial, only some 20 to 25 per cent. is actually radiated, the remainder being dissipated as $I^2R$ loss, where R is the effective resistance of the aerial and earthing arrangement. The radiated power is given by $I^2r$, where $r$ is the radiation resistance, a value equal to $2\pi f L \sin \theta$, where L=inductance of aerial, and $\theta$=phase angle between the magnetic flux and the current.

It is more probable that 3 kW represents the anode dissipation of the oscillator valves, as this is the usual method of rating valve transmitters in this country.

Anode dissipation is the product of normal anode voltage and anode current, and of this power some 75 per cent. represents the input to the aerial, of which, as explained above, some 20 to 25 per cent. is radiated in the form of electromagnetic energy.

**W. H. Date, B.Sc., A.M.I.E.E.,**
*Head of Wireless Section.*

The Polytechnic, Regent Street, London.
*March 24th*, 1925.

### Plate Aerials.

I have read with much interest the article on "Plate Aerials" which Mr. Mackness contributed to your last number. I wonder if Mr. Mackness has forgotten that hundreds of thousands of people are using an indoor plate aerial regularly with excellent results. I refer, of course, to the employment of a wire-spring mattress as an aerial. The bed in which you are lying may be used. It must, of course, be fitted with good porcelain castors.

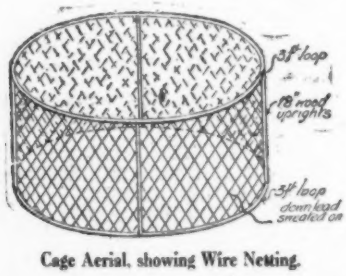
Important as is the question of the aerial—for we would all rejoice at the disappearance of outside wires—the provision of an "earth" requires almost as much attention. An insulated tin plate makes quite a good earth, but I have found that a very large basket coil gives such excellent results on a three-valve set ("Simplicity Three") that I have given up my outside earth. At night with this earth and a vertical aerial about five feet long—hitched to the picture rail at one end—good loud-speaker results are obtained at Hampstead from Savoy Hill.

The disadvantage of a short aerial, as Mr. Mackness points out, is the sensibility of the set and its liability to oscillate on the slightest provocation, but I am sure that there is here a fruitful field for research. It would be interesting to try a large sheet of fine copper gauze embedded in rubber and laid under the carpet. There is little doubt that it would make as good an aerial as the popular wire mattress. A similar sheet would make an effective earth. A chance for our manufacturers!

**Prior Lean.**

*March 24th*, 1925.

Referring to the article on the above subject by Mr. Mackness in your issue of March 20th, it may be of interest to him and to your readers to know that I have fixed several aerials of the capacity type, but in our case we have used two 3-ft. wooden (child's) hoops with 18-in. vertical struts covered with




**Cage Aerial, showing Wire Netting.**

ordinary 1-in. mesh wire netting stapled on with ordinary staples. The cage thus formed is suspended by means of suitable insulators on the top of a short pole fixed to a chimney.

The results are excellent, and where there is any difficulty in getting a span for an ordinary aerial I always recommend them in these cases.

I enclose a rough sketch showing the construction of these aerials.

**C. Culmer Hodges.**

Electricity Works, Dawlish.
*March 26th*, 1925.

### Street Explosions.

The alarming street explosions in the manholes of the electric mains, of which we have had an instance at Notting Hill, are not new, and it is usually asserted that such incidents are caused by leakage from adjacent gas mains, no other cause having hitherto been suggested.

I am of opinion that such explosions are due to quite another cause, *viz.*, electrolytic decomposition of water or humidity and the ignition of the resultant gases by short circuit, &c.

I am led to this conclusion by the fact that such explosions are always extremely violent—a constant characteristic of the inevitably correct proportions of oxygen and hydrogen produced by electrolytic decomposition.

An explosion of coal gas, on the other hand, might occur at wide variations in the proportions of gas and air. Anything above or below the critical mixture considerably weakens the explosion, which at its best or worst is mild in comparison with the violence of the absolutely correct mixture produced by electrolysis.

To know the cause is the first step towards finding the remedy.

**W. Love.**

London, *March 26th*, 1925.

### "Maxtorq" Motors.

I have noticed with interest two recent articles in the Electrical Review in which particular reference has been made to the Lancashire Dynamo & Motor Co.'s "Maxtorq" motors. The articles in question have pointed out the particular suitability of "Maxtorq" motors for, in the one case, short-rated applications, such as hoists, and in the other case, for continuously rated drives, such as spinning mules. Since the British Empire Exhibition the industry has heard much about this "Maxtorq" motor and what it will do, and since a machine having such unique characteristics as this has will undoubtedly be fully protected by patents, perhaps a little more light on a few points would help to convince doubting consumers of the particular advantages of the machine.

In the first place, are we to infer from the articles that the "Maxtorq" motor is a new type of machine ideally suited for both hoists and mule drives, or is it that the word "Maxtorq" is merely a trade name, such as "Yadil," and covers a variety of ordinary standard motors?

The use of high-resistance rotor squirrel-cage motors on certain drives was advocated by B. G. Lamme in 1897 when he read a paper before the N.E.L.A., and for quite a period at least one large firm in America, and another in Great Britain, put forward these machines as a regular product. With advancing design and general development, this type of motor has been gradually superseded, except for a few limited applications.

Reference is made in the second article to certain design characteristics whereby "when starting, the rotor current is banked up to the edge of the bars." This is so with all conductors carrying alternating currents, but the important point is to what degree. The photograph, fig. 13, on page 462, shows the construction of a "Maxtorq" rotor with simple rectangular bars brazed to apparently punched end rings. To say that this construction will result, on 50 cycles, in the well-known skin effect to such a marked degree as would appreciably affect the starting current is absurd.

In all humbleness, and as one much mystified, may I ask for figures? What is the ratio of standstill to synchronous resistance of a "Maxtorq" rotor, or what is the ratio of resistance on a.c. at line frequency to resistance measured on d.c. if such were possible?

On these figures, and these alone, does the true starting efficiency depend of a squirrel-cage motor when a given standard of full-load running performance is to be met.

**D. B. Hoseason, A.M.I.E.E.**

Bowdon, Cheshire, *March 26th*, 1925.

[The high torque, we understand, is due to the design of the slots, which, of course, is not indicated in the illustration referred to. No doubt the makers will give the desired explanation.—Eds. Elec. Rev.]

### Consulting and Contracting.

In the *Yorkshire Herald* of September 24th, 1924, appears a report of a special meeting of the Pickering U.D.C., to consider tenders for the proposed installation of electric light in the Memorial Hall. Mr. Piggott, electrical municipal engineer for Whitby, was the consulting engineer.

Various tenders were considered for the installation work in the building, and the tender from a local firm was accepted for this work, subject to the work being done in conformity with Mr. Piggott's requirements.

This matter having been settled, the next business was to consider Mr. Piggott's tender for the engine and generating plant. In this case, only one estimate was considered, given in the form of a letter from Mr. Piggott, amounting to three times the amount of the value of the contract mentioned above.

After a suggestion that further tenders should be asked for was not agreed to, Mr. Piggott's tender was accepted by the casting vote of the Chairman.

My Council feel that this is a position that cannot be tolerated. Mr. Piggott is a whole-time servant of the Whitby U.D.C., and should not therefore enter into contracts as a contractor without the expressed permission of the U.D.C. given at a meeting properly convened for that purpose. Even if this consent has been given this form of competition is very objectionable, especially when it is remembered that consultants themselves view with a large amount f disfavour any suggestion of a consultant quoting directly for, and obtaining a contract for, installation work.

It is difficult to see how in the future this competition can be eliminated, other than with he consent and co-operation of the various manufacturing and wholesale firms in refusing to quote for, or supply goods to, gentlemen in the position of Mr. Piggott.

**Leonard G. Tate,**
*General Secretary, N.E.C.T.A.*

London, *March 25th*, 1925.

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### Sea-going Electricians.

With reference to the above, and "Once a Batti-Wallah's" information which appeared in the "Correspondence" columns of the REVIEW of January 9th, I should be much obliged to him if he would be so good as to give me some information on the following questions, as early as possible, through the REVIEW:—

1. What experience does he consider suitable for the above?
2. What is the type of work, or what is the daily routine of an electrician (*a*) at sea, (*b*) in port?
3. What class of plant is usually met with on ships of the lines mentioned?

**Cymro.**

*March 23rd*, 1925.

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### The Electric Iron.

It is surprising that the electric iron in its present form has survived so long. It must, I think, be admitted, after careful reflection, that in its present form it is a highly dangerous piece of apparatus, especially for domestic use. It is offered to the public for the use of domestic workers entirely ignorant of electricity. Its operation is such that one is asked to plug it into a wall socket, or lampholder, and "wait" until it is hot. During the "wait" the user, more often than not, leaves the iron to attend to other matters, and in many cases forgets about it, only to be reminded of its presence by a smell of burning. Even during the process of ironing one is often called away, and the iron is left in circuit, in close proximity to clothing or woodwork, often with disastrous results. There is not one user in a thousand who realises that if left long enough the iron will become red-hot and possibly burn through the table and even the floor.

The electric iron is one of the few electrical devices giving no visible or audible indication that the current is on, and yet it is offered to the public with complete confidence.

The underwriters in America give the figure of 5,000,000 dollars as the amount of damage caused through electric iron fires last year. The insurance companies in this country, I think, attribute a very high percentage of fire claims to this culprit. It would be interesting to hear the views of some of your readers on this important point.

In conclusion, various makers claim virtues and points of superiority for the following:—

A. Thumb rest.
B. Tip-up stand.
C. Cool handle, by virtue of air gap between cover and stirrup.

The thumb rest is a very doubtful virtue, its position in many cases causing strain rather than rest.

The tip-up rest or stand, in the writer's estimate, is unpractical; it is a very great strain on the wrist, especially for a lady, to tip up a 5-lb. iron at short intervals during ironing, and it is in most cases never used.

The virtue of the so-called cool handle is difficult to understand in view of the fact that the fixing bolts that secure the stirrup are screwed into the sole plate, thereby raising the stirrup to the same temperature as the sole plate, by direct metal-to-metal contact.

**Observer.**

London, *March 24th*, 1925.

[Our correspondent, we think, has greatly exaggerated the danger of fire attaching to the electric iron, whilst underrating the advantages of the tip-up stand and the air gap. There is always room for improvement, and the ideal iron would, no doubt, be equipped with brains to make good the deficiencies of the user; but our own experience is that the electric iron is a most useful, practical, and safe appliance in domestic hands.—EDS. ELEC. REV.]

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### Billiard Table Ironing.

Users of irons for billiard tables complain that electric irons make marks on the table. This is because the iron warps with the heat, and thus is not flat enough for the very accurate surface of the table.

It will be interesting to hear the experience of others in this direction, and particularly of the method adopted for overcoming the difficulty.

**Billiards.**

*March 23rd*, 1925.

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### Aeroplane Crashes and Ignition Circuits.

The letter from Mr. Clark in your last issue has caused me great surprise, as I had no idea that what I have always considered the incorrect method was in such considerable use. Whether my views are right or wrong, I should like to see the matter definitely settled by actual measurement, if someone will be kind enough to do it. I have not the apparatus and cannot go beyond the use of the additional spark-gap across the condenser to indicate the presence of a fairly high voltage. It may be, as Mr. Clark states, that a similar comparatively high voltage is produced in the condenser when connected as in fig. 1. If so, then why do some well-made condensers and magnetos fail so repeatedly and others do not do so?

I should like to state that I have no financial or manufacturing interest in either method, and that my sole object in raising the question is for the sake of the lives of those who go up in aeroplanes, and to save inconvenience to motorists.

Mr. Clark does not question the correctness of fig. 1 in any way whatever, but does his best to defend figs. 2 and 3. We both, as electrical engineers, continue to differ in our opinions. Meanwhile, aeroplanes continue to crash (*vide* the daily papers), and motorists to complain of their magnetos (*vide* enclosed cutting from a recent motoring journal).

It is all very well to regard the primary coil as part of the secondary in figs. 2 and 3. Its value for that purpose is very small and is purely accidental, due to the incorrect method of connection. It was never intended for that use, as no capable designer of ignition coils, after taking elaborate care to insulate every layer of his well-insulated secondary wire,

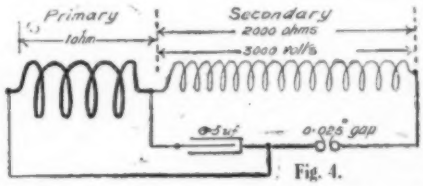

Fig. 4.

would add to it another winding of thick wire having weak insulation itself, and weak insulation between layer and layer. This weak insulation is quite satisfactory for the purpose for which it is intended provided the coil be correctly connected, but is distinctly hazardous when used as part of the secondary coil, as the high secondary voltage is liable to spark across all the layers, thereby short-circuiting the primary and stopping the engine quite as effectively as if the condenser had failed.

Now as to Mr. Clark's reasons for considering my argument to be baseless:—

No. 1. Majorities are not always right, and are probably more often wrong.

No. 2. The fitting of dual ignition to all aeroplanes is a convincing practical admission of the insecurity of the present ignition circuit; whereas it should be as reliable as the shaft which turns the propeller. On fighting machines, where connections may be shot away, duplication is, of course, essential, but for quite a different reason. How is this dual ignition used? Are both run together, or does the pilot switch over from one to the other, when one fails? In the first case, he would not be aware of one failing, and in the second he would not know how near he was to a failure of both, if one had already failed. One engine with a reliable ignition circuit is worth far more than two engines, each with dual ignition, if the latter be doubtful.

No. 3. The excessive potential across the condenser in the case of fig. 2 is proved by the additional spark-gap fitted in series with one hundred ohms non-inductive resistance across the condenser, and quoted in my first letter. In my opinion, this excessive voltage is due to the connection with the secondary winding, and is not there in fig. 1, because there is no connection to the secondary.

No. 4. I quite agree that energy is momentarily stored in the condenser, due to the break in the primary in both cases of fig. 1 and fig. 2, as that is the reason for the condenser being there. In the latter case there is, in my opinion, the energy from the secondary current, added to that already there: the sum of the two giving the excessive voltage referred to.

As an electrical engineer, will Mr. Clark give his opinion of the impedance of the following circuits:—

(*a*) A plain condenser of half a microfarad;
(*b*) The primary winding of a spark-coil of 300 turns wound on a substantial laminated iron core,

when both are subjected to an a.c. voltage of 3,000 volts having a frequency of 200 periods? If now these two circuits be connected in parallel, fig. 4, what would he expect to happen to that paper-insulated condenser designed to stand a.c. at not more than 250 volts? Would he risk his life on its ability to stand up to that stress? With the correct

method of connection the ordinary good-class coil and paper condenser will not fail during the life of a Rolls-Royce engine; the spark-plugs would not all give out at once, and even when one does do so it requires only a slight closing of the spark-gap to make it the equivalent of a new plug. How often good plugs are discarded because of "no spark"! It is this trouble of repeated failures that must be remedied, and this discussion will be worth while if it effects that result, whether my views are right or wrong. My experience with connections as in fig. 1 during 27 years' motoring has encountered no failure, and only four defective plugs, one with corroded wire at the porcelain, a second a mica plug which collected burnt oil and shorted at about every hundred miles, and the other two by accidental mechanical breakage. Will other readers give their views and experiences?

Finally, may I express my disapproval of Mr. Clark's last paragraph, as not helping to elucidate the matter, and as being in bad taste? The American firm responsible for the remark are quite as noted as the Rolls-Royce Co., and whether they are right or wrong in their view, their practice is, in this instance, the same as that of the Rolls-Royce Co.

**A. C. Booth.**

London, *March 30th*, 1925.

[The cutting referred to is from *The Motor* of March 10th. Mr. J. G. Parry-Thomas, in a letter, mentions failures of magneto ignition, and compares British with foreign magnetos to the disadvantage of the former; and Lt.-Col. V. E. H. Lindesay describes breakdowns experienced with British but not with foreign magnetos.—EDS. ELEC. REV.]

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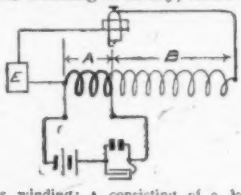
I was very interested to read Mr. A. C. Booth's article on magnetos. I should like him to comment on the enclosed sketch.

Having examined a number of defective magnetos, I am of opinion that most of the faults found are due to the condensers. Where the winding is faulty, there is generally found




A and B, continuous winding; A consisting of a low-resistance circuit of heavy wire, and B being a relatively high-resistance circuit of fine wire, say a ratio of about 100 to 1.

a green deposit; whether this is due to some maker's enamel on the wires, or the insulating material, I am unable to say.

**K. Cardiff.**

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With reference to the foregoing letter, the diagram shown is the equivalent of fig. 2 of my article in your issue of March 13th. There is no proper circuit for the secondary current, other than by one or more of the three paths (*a*) the make and break, (*b*) the primary, and (*c*) the condenser—with the risk of destroying the condenser in time, of breaking down the light insulation of the primary, and of increasing the rate of deterioration of the make and break contact points.

It would be of interest to know the actual connections of the magnetos in which the condensers had failed. The green deposit may be due to dampness followed by sparking; but it has also been found to be due to action on the copper wire by insulating material or paraffin wax containing a very small portion of acid.

**A. C. Booth.**

London, *March 30th*, 1925.

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### Three-phase Four-wire Distribution.

Being interested in the subject of three-phase four-wire distribution, I have found it difficult to obtain detailed information concerning this system.

Theoretically, it would seem that this system is the best from the point of view of size of cables, but I have heard that it is not to be recommended. On inquiring the reason for this, I was informed that it was difficult to obtain good regulation, and that motors working on this system (presumably single-phase motors working across one outer and neutral) caused violent fluctuations in any lights connected.

Most of the books to which I have referred do not deal very fully with this subject.

Would you or any of your readers be good enough to supply me with any information concerning this method of distribution or, alternatively, refer me to any literature dealing with the subject?

**Three-phase.**

*March 23rd*, 1925.

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**Inventors' International Institute.**—The *Electrical World* announces the establishment of the Inventors' International Institute at 15, Park Road, N.Y. The Institute is designed to advise inventors upon the practicability of their inventions and the possibility of obtaining patents for them. The governing body of the Institute will be a board of engineers consisting of many of the prominent engineers of the States.

# Published Specifications.

**Compiled expressly for this journal by Patent Agents.**
**The name of the applicant's patent agent, if any, will be found on the printed specification.**
**The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.**

### 1923.

24,752. "Damping devices for vibratory apparatus." Signal Ges. October 18th, 1922. (205,797.)

27,939. "Dynamo-electric machines." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. November 6th, 1923. (230,137.)

28,044. "Induction motors." J. Lyons & Co., Ltd., and A. G. Goddard. November 7th, 1923. (230,139.)

29,538. "Connecting devices for electrical instruments, apparatus, and the like." H. F. Loveland. December 11th, 1923. (230,143.)

29,807. "Electromechanical apparatus for the transmission and reception of alarms of fire and other signals." J. Trimble. November 27th, 1923. (230,144.)

30,072. "Electrical wave-receiving systems." Western Electric Co., Ltd. (Western Electric Co., Inc.). November 29th, 1923. (230,150.)

30,085. "Cooling or ventilating of dynamo-electric machines or other apparatus." J. A. Kuyser, A. J. Syers, E. L. N. Towle, and Metropolitan-Vickers Electrical Co., Ltd. November 29th, 1923. (230,151.)

30,342. "Automatic adjustable holder for candles, electric lamps, and the like." J. Grove. December 3rd, 1923. (230,161.)

30,343. "Variometers." G. Pelletier. December 1st, 1922. (207,835.)

30,450. "Contact devices for electrical ignition apparatus for internal-combustion motors." H. S. Budge and H. Knowlson. December 4th, 1923. (230,164.)

30,479. "Electromagnets for unlocking miners' electric lamps." The Electric Safety Lamp Co., Ltd., and T. Stretton. December 4th, 1923. (230,166.)

30,573. "Locking devices for electric incandescent lamps." J. Dooley and G. J. Parnell. December 5th, 1923. (230,171.)

30,637. "Controls for wireless receiving sets and other electrical apparatus." Gramophone Co., Ltd., and B. E. G. Mittell. December 5th, 1923. (Cognate application 11,607/24.) (230,176.)

30,741. "X-ray tubes." S. Ruben. December 6th, 1923. (210,403.)

30,746. "Electric secondary batteries or accumulators." H. F. Joel, Sen. December 6th, 1923. (230,184.)

30,881. "Railless roadway for vehicles employing electric traction." L. Belloni. December 9th, 1922. (208,164.)

31,079. "Wires or cables for wireless aerials or for other purposes." E. E. Makinson. December 11th, 1923. (230,192.)

31,945. "Electrolytic refining of metals." Aluminum Co. of America. December 21st, 1922. (208,711.)

31,946. "Methods of lining electrolytic cells for refining metals." Aluminum Co. of America. December 21st, 1922. (208,712.)

32,123. "Continuously-loaded conductors." Land und Seekabelwerke Akt. Ges. December 27th, 1922. (209,074.)

32,191. "Hydraulically-actuated devices." English Electric Co., Ltd., and P. W. Leewer. December 22nd, 1923. (230,205.)

32,489. "Electric control apparatus." C. G. N. Poolman. December 29th, 1923. (Cognate application 22,765/24.) (230,207.)

### 1924.

662. "Circuit arrangements for automatic telephone exchange systems." Siemens Bros. & Co., Ltd., and D. A. Christian. January 9th, 1924. (230,214.)

858. "Operation of electrical circuit-breakers." R. D. Gifford and Nalder Bros. & Thompson, Ltd. January 11th, 1924. (230,216.)

1,213. "Earpieces of telephonic apparatus." P. Thomas. January 16th, 1924. (230,221.)

1,708. "Thermionic valves or electron discharge tubes, particularly for wireless signalling." L. A. Levy. January 22nd, 1924. (Cognate application 25,025/24.) (230,226.)

2,260. "Motor-car headlights and like lamps." F. G. Piper. January 28th, 1924. (230,231.)

2,460. "Bricks, slabs, tiles, panels and the like, or electric insulators." Presspan-Und Isolations-Materialien-Werke für Elektrotechnik Vorm. H. Weidmann Akt. Ges. January 30th, 1923. (210,779.)

3,160. "Coupling devices for electric cables and the like." F. Kay. February 7th, 1924. (230,240.)

6,130. "Process for manufacturing electrical wireless resistances." H. Hediger. March 14th, 1923. (212,912.)

6,908. "Variable electric condensers." Wilkins & Wright, Ltd., and J. H. Hewitt. March 18th, 1924. (230,274.)

7,641. "Crystal detectors for wireless telephony." E. H. F. Chateau. January 7th, 1924. (227,406.)

8,600. "Impulse-sending arrangements for telephone systems." Siemens Bros. & Co., Ltd., and H. E. Humphries. April 5th, 1924. (230,291.)

11,695. "Starters for electric motors." Bayerische Elektrizitäts-Industrie Rott & Co., and A. P. Visser. May 5th, 1923. (215,392.)

11,227. "Galvanic batteries." Soc. Anon. Le Carbone. April 10th, 1924. (230,307.)

13,218. "Electrically-propelled vehicles." E. Pellone and E. Serisano. May 29th, 1924. (230,321.)

13,228. "Magneto-electric machine." O. Kraus. May 29th, 1924. (230,322.)

13,481. "Electric arc lamps." British Thomson-Houston Co., Ltd. June 1st, 1923. (216,900.)

14,388. "Electric heating apparatus." J. Wangler Ges. June 13th, 1924. (Addition to 213,897 as modified by 218,273.) (230,327.)

15,018. "Automatic reclosing circuit-breaker systems." British Thomson-Houston Co., Ltd. October 3rd, 1923. (222,830.)

16,609. "Apparatus for wireless installations." W. Green. July 10th, 1924. (230,338.)

16,966. "Electric heating units." Metropolitan-Vickers Electrical Co., Ltd. July 20th, 1923. (219,314.)

20,188. "Electric illumination control systems." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). August 26th, 1924. (Addition to 180,146.) (230,360.)

22,632. "Machines for the manufacture of wire strands, wire cords, wire ropes, wire cables, electrical cables, conductors, and the like." W. O. Larmuth. September 25th, 1924. (230,374.)

22,725. "Machines for the manufacture of wire strands, wire ropes, wire cords, wire cables, electrical cables, conductors, and the like." W. O. Larmuth. September 26th, 1924. (230,375.)

22,853. "Dry electric batteries for radio transmission and reception." H. Gebhardt and Electro-Chemie Akt. Ges. September 27th, 1924. (230,377.)

24,837. "Commutators for electric machines." Siemens-Schuckertwerke Ges. November 2nd, 1923. (224,217.)

### 1925.

2,025. "Electrical transmission of images." Western Electric Co., Ltd. (Western Electric Co., Inc.). September 7th, 1923. (Divided application on 228,961.) (230,401.)

3,982. "Electric current collectors for railways." A. E. Vidal (R. E. Hudson). December 7th, 1923. (Divided application on 30,800/23.) (230,408.)